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The Distribution of Unemployment.

The statistics of employment issued by the Ministry of Labour show very marked variations as between one district and another, and one town and another. It is sometimes assumed that, apart from one or two so-called distressed areas, unemployment is uniformly distributed, but this is by no means the case. What common factors are at work to reduce unemployment below 10 per cent. in such widely diverse large towns as London, Edinburgh, Derby and Aberdeen? Why should the figures for Birmingham and Manchester be virtually identical?

Considering the large towns with an insurable and insured population of over 50,000, the figures for London and the surrounding areas economically belonging to and dependent on London, such as parts of Essex and Middlesex, and for many cities in the Midlands, especially Leicester and Nottingham, are not really bad. For the towns of intermediate size, with an insured population of 20,000 to 50,000, a line joined between Bristol and Grimsby shows that south of it there is comparatively little unemployment, while north of it has by far the larger part of the registered total. In some of the Lancashire and South Wales towns the figure approaches, and in one case even exceeds, 50 per cent. In no town in the northern section of this group does the figure appear to fall below 12 per cent., while in the southern section it is as low in one case as 3.4 per cent. Of course, many southern towns are purely residential or have purely local industries unaffected by export markets, but there are signs that even the hitherto prosperous sections of the community are now feeling the pinch. The great distributing houses and stores are likely to provide a few shocks for shareholders in the near future. Small towns wholly dependent on one staple trade, such as the colliery centres, show the worst figures. Thus, one centre in Northumberland has a figure of 71 per cent., three out of four insured persons being unemployed, and a South Wales mining town is even higher. The same applies to other industries. Thus, some of the cotton towns of Lancashire show nearly 70 per cent. It is the old problem of all the eggs being in one basket. The national character of the problem is obvious, because the greatness of Britain is based on her export trades and basic industries, the workers in which, and the welfare of which, is the first concern of a statesmanlike Government. We should judge that the foundry centres, as distinct from textile and coal-mining areas, do not show figures anything like as bad as those indicated above. Thus, Falkirk has 14.2 per cent., Smethwick 12.2 per cent., and these are typical. Birmingham has 13.4 per cent. and Manchester 13.9 per cent. These general tendencies in distribution are also confirmed by the report of the Chief Inspector of Factories and Workshops, recently issued.

The Change of the Tide.

We are concerned at the attitude adopted by some of our contemporaries when they make reference to trading conditions. "Railway companies' recent dividend announcements . . . dispiriting" and "Unfortunately, very few signs of any improvement in the industrial barometer" are typical quotations. It is useless to blind oneself to facts, but there are a number of factors which are tending in the direction of improved trading conditions. Primarily, there is a realisation by those at the head of affairs in the United States that their domestic trade *is* governed by international matters, and they cannot prosper whilst other countries languish. The translation of this "realisation" into practical politics will have a world-wide repercussion. A second factor is equal importance is that the experts assure us that the prices now ruling in the metal markets will not be further depressed. The last factor is that there is a distinct halt in the pruning schemes associated with the various rationalisation efforts. Associated with this is a feeling in the Dominions and many of the South American countries that they must buy from their best customer, which usually happens to be Great Britain.

It is not generally realised that the buyers in Covent Garden and Smithfield markets have been, and are, very enterprising. They do not hesitate to create a market by taking a shipload of some new produce, whilst other countries take in what is virtually a retail quantity to "test the market"—a factor greatly appreciated by countries of mainly agricultural interests.

The British manufacturer has been accused of failing adequately to cater for foreign markets, usually on the ground that the quality is too high. In the automobile field, for example, it is said that British cars are not built to withstand the rough usage to be associated with undeveloped roads, but road conditions are everywhere improving, and with them a demand for British cars. Especially did we notice this condition during a recent visit to Belgium after an absence of a few years. Thus, conditions are always tending towards the absorption of higher-grade materials of the British type. There has only to be a movement towards the covering for future deliveries whilst commodity prices are low to effect a serious improvement in trade, and on every side we hear discussions as to whether current opportunities should not be seized, and from them there is every reason to believe that the tide is turning, if not definitely on the flow.

XUM

Correspondence.

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

Motive Power for Moulding Machines.

To the Editor of The Foundry Trade Journal.

Sir,—On reading Mr. A. S. Beech's article on motive power for moulding machines, I notice he very lightly touches on the possibilities of moulding machines being worked from an electric supply circuit.

I must point out that my company have had two electro-magnetically-actuated moulding machines in constant operation, one for at least eighteen months and the other for at least three months, without any repair charges of any kind.

From our experience gathered over two years of experimental work on these machines, we know that magnetic power will do exactly the same work as either air or hydraulic at much less cost. To compress a mould 440 sq. in. in area takes no more than two seconds in time (and consumes $\frac{1}{100}$ of a unit), and it is therefore easy to understand that the amount of electricity consumed in one day's work is very little.

The pattern-draw on the above machines is by gravity through the medium of an oil dash-pot, which is as good as, if not better than, hydraulic.

Seeing that my company hold a number of British and foreign patents on moulding machines using magnetic power, I thought it advisable to correct Mr. Beech's misstatement and to let the foundry trade know that a new cheap motive power is now available for foundry moulding machines.—Yours, etc.,

Thos. W. Bullock,
British Insulated Cables, Limited.

Prescot, Lancs,
August 6.

Publication Received.

The Operation of the Foundry Cupola, Part II. by Edward E. Marbaker, Ph.D. Published by the Whiting Corporation, Harvey, Illinois, U.S.A.

In this section Dr. Marbaker deals with the arithmetic of the air supply to the cupola; the results of actual cupola operation; blast pressure, conservation of waste heat, and the design of the tuyeres. This matter is well illustrated by two useful tables and is contained in an eight-page pamphlet. We were pleased to see that the conservation of waste heat by the column of coke and iron is stressed, as it is a factor which is sometimes overlooked. These communications from the pen of Dr. Marbaker are extremely useful, and ironfounders would do well to have their name placed on the Whiting Company's mailing list.

Cotton Driving Ropes.—The horse-power of any size of driving rope commences to decrease when the velocity of the rope exceeds 4,800 ft. per min. This is due to centrifugal force, and consequently a rope should never be run at, say, over 4,500 ft. per min. if the maximum power is desired.

Nickel and Stainless Steel will not pickle well in the usual pickling solutions. The best solution is a mixture of sulphuric, hydrochloric and nitric acids in about equal proportions. This will produce a good white surface. When drilling deep holes, borings at the bottom of the hole can be removed by a magnetised steel rod inserted into the hole. For grinding stainless steel, use as a lubricant a mixture made from one gallon of water, two ounces of carbonate of soda and half a pint of lard oil. Stainless steel is dense and dissipates heat slowly; therefore, use plenty of lubricant and be careful to avoid overheating.

Catalogues Received.

Carborundum Crucibles.—We have received from the Carborundum Company, Limited, of Trafford Park, Manchester, a copy of the booklet devoted to this commodity and to refractories made from carborundum. The brochure has been very intelligently arranged and presented; the system followed has been to stress when dealing with the properties of carborundum—its exceptional refractoriness, its high thermal conductivity and its low coefficient of expansion. This is followed by a succinct statement of the special features of carborundum crucibles and their use in non-ferrous foundries, which in the main are due to the properties we have indicated. Finally, a section is devoted to other carborundum refractory products, amongst which we note with interest that the muffles made from this material are being used by the light-castings foundries for enamelling sanitary ware. Tubular recuperators, made from "Carbofrax," are used in a popular make of reverberatory furnaces.

Foundry Requisites and Equipment.—The Blackfriars Foundry Requisite Company, Limited, 34/35, Norfolk Street, London, W.C.2, have prepared a very comprehensive catalogue, divided into two main sections—supplies and equipment for the foundry industry. There are 111 well-illustrated pages. The specialities outlined have been well chosen, whilst the range is extremely wise. After perusing the catalogue one is convinced that once a shop is erected and provided with cranes, the firm is in a position to furnish almost everything else—melting plant and sand-preparing machinery, right through to the fettling and sand blasting. This catalogue is of great value to this industry, as it allows the management to take cognisance of alternate methods of doing any one particular job, as it indicates the great range of materials, types of plant and tools available. We strongly recommend the acquisition of this catalogue as a valuable addition to the buyer's library.

Air-Tempering Ovens.—Messrs. Wild-Barfield Electric Furnaces, Limited, of Elecfurn Works, North Road, London, N.7, have utilised an 8-page brochure to describe their latest electric air-tempering ovens. The material to be tempered, contained in a basket of perforated metal, is lowered into an electrically-heated chamber, properly insulated. On the floor of this chamber is a paddle fan of special design, which draws the air over the surface of the heating elements, through the charge and again over the heaters in a continuous cycle. It is claimed that an efficiency of 89 per cent. is achieved. The whole process appeals to us as a distinct advance over the now old-fashioned lead and salt pots.

Ladle Gears.—The Whiting Corporation, of 15699, Lathrop Avenue, Harvey, Illinois, U.S.A., has sent us a leaflet which illustrates and describes four types of ladle gearing, ranging from the simple pin-spur arrangement to the ball-bearing, helical worm-geared type running in an oil bath. This latest development brings American practice to the same stage as the best European.

Lignum Vitæ Blocks are best stored in a tub of oil (disused or old oil is suitable), and kept in a cool, moist atmosphere. If kept in water, they are apt to crack, especially with an open heart.

Tempering Steel Springs.—Springs can be hardened and tempered to a fairly high degree by the following method. First see that the spring is thoroughly clean and free from rust. Then heat it to a deep red heat and plunge into a cask of lubricating oil. Withdraw the spring and hold it in a flame until the oil is flashed off, and immediately withdraw it from the flame.

Random Shots.

I hope you all enjoyed the Bank Holiday. There was a little more optimism from the experts, for the Federation of British Industries economic forecast of trade tendencies, while it conveyed that the end of the depression has not yet been reached, did suggest that we should very soon touch bottom and be on the rise again.

* * *

I have been asked to give in a little more detail my views hinted at last week about the necessity for collective action to take our industry's future seriously. As I see it, the position is something like this. The whole of the vast modern engineering industry began in the foundry. All, or practically all, machine parts were made in cast iron as a matter of course. The cast iron was the re-melt of the natural product of the small cold-blast furnace. It was used because it was available and because it happened to fill without obvious faults the mould into which it happened to be poured.

* * *

It was natural and inevitable that other materials should develop and that they should be used in fresh applications in a rapidly expanding industry. But the rate of expansion was itself so rapid that cast iron could see its field nibbled at by these other materials, particularly the steels, without alarm, because its own rate of growth continued to increase.

* * *

The time has now arrived, however, when we can no longer accept this state of affairs. The fact is that the output of cast iron as such has not markedly increased over a period of twenty years, say, eliminating for the moment the disturbing effect of the war, which created an artificial demand.

* * *

The manipulation of cast iron has called into existence a body of both craft skill and technical skill. If this skill is to receive its natural reward, and if its exponents are to work in the stimulating atmosphere of a growing industry which appeals to the ambitious, then the trade must not be permitted to decline.

* * *

We are all in this. Manual workers and staff workers, laboratory men and those in the equipment and supply business. We sink or swim together. Hence the need, in my view, for strong collective effort to boost our material and method.

* * *

I do not suggest that cast iron should be used for unsuitable applications or over-developed in a way which causes reactions of an undesirable character. But we have begun to find that cast iron is not used merely because it is cheap and amenable, but because it is better in many ways for the purposes it now serves than any alternative material. Hence we do not want mere propaganda, but we do want to find and proclaim the truth, so that a man who uses aluminium pistons in hardened steel liners does so because this combination is better than any alternative, and not because he has been let down on cast-iron products through some foundry not being up to its job. The aluminium founders, being new, are on their toes to find these applications. Are ironfounders?

* * *

Every cast iron above twelve or fifteen tons tensile ought to have a new name, because in some ways this particular dog has a bad one in quarters not easy to convert back again.

* * *

Don't rely always, in holiday motoring, on the fact that the right of way is yours. There is a little rhyme about a man who did so, who was "right, dead right, as he speeded along, but who is just as dead as if he'd been wrong."

Marksman.

Materials-Handling Costs in Jobbing Foundries.*

By F. D. Campbell.

The foundry industry has ordinarily been divided into metal groups, but for any efforts toward solution of economic problems, divisions must be made with respect to types of business, production methods, quantities and types of product. The industry is rather well developed when matters of processes are considered, but a great portion of it, as a whole, still is afflicted with high labour costs, when compared with other industries.

A Challenge to the Foundry.

The great strides made in the manufacture of motor cars and other domestic necessities having cast component parts have been the means of rapid development in reducing labour costs in the types of foundries catering to those products. Such products lend themselves well to proper planning and straight lining of production, and the remarkable results achieved in low costs of production constitute not only a challenge to the rest of the foundry industry, but an indication of what it must be prepared to accomplish in the near future.

The broad fabric of the foundry industry caters to the general casting business. It consists of the jobbing foundry, the semi-production foundry, the production foundry (making miscellaneous castings, miscellaneous metals or alloys), air-furnace malleable-iron foundries, and periodic or seasonal products. This category will be referred to frequently as the average type of foundry.

Conceding satisfactory progress in processing, pattern practice, furnace practice, knowledge of moulding sands, moulding, cleaning and heat-treating, what can the so-called average foundry do further to better itself? What is the remaining point of attack to make further improvement, to secure better costs, more profits?

Labour Costs Must be Reduced.

Every foundryman knows the answer. It is in labour costs. Most foundrymen, probably, can see an approaching change, a natural evolutionary trend born of economic necessity, but the question is, how can reduction in costs be effected? The element of labour costs presents a fertile field for investigation.

The foundry, primarily, makes a product that has a comparatively high proportion of labour cost in it. This is evidenced by the fact that, generally, of a dollar of net sales, direct, indirect labour and supervision represents over 45 per cent., with all materials at about half the labour item (ferrous plants); wherein, on the average, with other manufacturing industries, materials and labour approximately balance.

It is not purposed to present any discussion of cost-accounting methods, overheads, or what constitutes indirect labour, references being confined to labour—all labour of whatsoever description—which constitutes outgo in the form of pay-rolls. There are many and various methods of cost accounting in foundries, with no general agreement on merit, and this broad diversity of method probably accounts for a prevailing broad diversity of opinion regarding excessive items of costs, resulting in frequent journeys down blind alleys in search of cost-reduction possibilities.

Cost of Mass-Weight Movement.

As evidence of what is probably the largest possibility in labour cost reduction, consider for a moment the mass weight that must be moved, carried, or lifted to produce castings—core sands, cores, moulding sand, castings, flasks and other accessories, all in some continuously mobile state. Add to this great weight movement all the handling and rehandling of products in varying stages of process to deliver the finished article.

The grand total of weight movement to produce 1 ton of finished castings is variously from 40 to 150 tons. And many foundries still are moving a great amount of this aggregate weight by man-power.

Approximating one man at about one-tenth horse-power at 50 cents per hr., of $5.00 per h.p.-hr., man-power for mass weight movement is tremendously expensive by all accepted standards.

Necessity of Proper Lay-out of Foundry.

When there is a necessity for greater production with no apparent extra available space in premises, enlargement of quarters may have little effect on cost reduction if the yield per sq. ft. of floor space is not increased. Funds for new building may not be available, or, if they are, expenditure may be injudicious in the face of uncertain continuous demand for products.

Also there is the question of sufficiently rapid build-up of tonnage to prevent additional floor area becoming a heavy cost burden. In the matter of either requirement—that of reduction in cost of present or existing tonnage, or increased tonnage without corresponding increased cost or additional outlay—the problem is the same.

In surveys of many average foundries, one common prevalent condition was noted, that of illogical interior arrangement of departments, equipment, storages, furnaces or cupolas, etc. This general condition results in waste motion, excessive labour, confusion, disorder, uneconomic use of floor space and equipment, delays, accidents, a higher semi-processed inventory, an extended manufacturing cycle and a lower turnover of both floor area and capital.

The average foundry's operating space is about 40 per cent. storage, due to a conception that everything must be handy. Thus, that which should constitute active operating area exclusively is usually partly filled with inactive materials—flasks, boards, bands, etc.—some infrequently used. These storage areas are traps for *débris* and dirt, and cause rapid deterioration of equipment.

Moulding Requirements.

Moulding, which is the vital part of the foundry, is generally restricted in operation, due to disorderly storages, unrelated flask-storage locations and, in the case of hand-pouring, the use of much floor space as aisleways to reach all moulds laid out on the floor in an immobile state.

When moulds are of sufficient weight to require more than one man to lift from the machine, either others must leave their tasks to assist in carrying out sections or moulds, or cranes must be brought into action.

The accumulative time lost during the day, waiting for cranes in the handling of medium-sized work, is surprising in its magnitude. In connection with hand-made moulds on the floor, moulders are at a decided disadvantage in having to operate at many places over a considerable area, with much walking and carrying of sand and materials from available points to the particular spots where the moulds are being made at the time.

If floor moulders operate from large heap-sand floor storages, the work is carried on under the worst possible conditions of fatigue, inefficiency, hard labour and low production. And, when the day's work is laid out, it will be found that it actually occupies about 50 per cent. of the floor space, because of moulder's required operating space around each mould. Raking out the castings over a wide area will consume so much time as to reduce the effectiveness of floor area, due to the decreased production turnover of the floor. A further restriction is in the unorganised method of flask movement in retiring unwanted sizes and replacing with required sizes, and the costly time element in delay to effect these changes.

Hand Pouring by Moulders.

Hand pouring by moulding operators is costly compared with a trained pouring crew. Usually a realignment of labour about the plant will recruit sufficient labour for pouring when the balance of operations has been put on a proper basis. Responsibility may be vested in a good inspection crew for determining moulding or pouring fault in defectives. Another indictment of moulder pouring is that, after a number of hours of moulding, when the operator has done his best work and is nearer the fatigue point—lowest in physical energy and mental alertness—he is faced with the most difficult and hazardous task of the day.

Frequently the operator soon learns his physical limitations and will put up only the number of moulds that he can possibly finish and pour off, thus fixing a low limit in earning for an allotted floor space. Studies made of this operation have indicated that it is not only highly wasteful, a breeder of accidents and burns, but also a direct cause of high labour turnover.

Shake-out and Cleaning.

Shaking out over a wide floor area is costly, in labour involved to collect castings and to handle and condition sand, and in poor quality of sand conditioning and a resulting dust-laden atmosphere.

Cleaning operations in the ordinary way mean a conglomerate collection of product, movement from one point to another, without semblance of order or sequence. Generally, no matter how far behind the cleaning department may be, product is poured into it because of lack of storage space, resulting in greater confusion, increased inventory, longer time to get material through and a rising curve in ton-cleaning costs in proportion to increased content results. With increased content of product, decreased contact time in processes follows.

On the average, the cleaning room is the notably unbalanced part of foundry operation, and it is the phase of production to which least attention has been devoted in any effort to correct obvious faults.

Wage Incentives.

Wage incentives have been the hope of cost reduction, and have accomplished a great deal. That the greatest benefits have not thus far resulted from wage incentives alone is due to the fact that the application has been made to operations under conditions imposing great handicaps because of excessive basic labour. With the elimination of all possible labour, primarily, by whatever method wage incentives may then be applied to the minimum labour requirement on re-established rates. Wage-incentive plans will improve existing conditions somewhat, but if applied after waste labour has been eliminated, such remuneration methods will provide the spur to effort and intelligent co-operation on the part of the operating personnel to produce the desired results. The point is that wage incentives are highly advocated, but should be introduced under proper auspices and conditions that will produce the greatest effectiveness.

It is believed that it will be evident, from a study of the foregoing, that the greatest single element in foundry operation that is presented as a possibility in lowered costs is in labour saving at every point where it can be accom-

* A Paper read before the Cleveland Meeting of the American Foundrymen's Association. The author is chief engineer of the Eastern Corporation, New York.

plished. The greater proportion of labour reduction will be found in labour movement of materials.

The primary move is a plan of arrangement of operations based on a flow chart of sequences from the first operation through to the point of delivery of finished castings, eliminating all possible cross traffic or reverse movements. A straight line of movement is ideal and should be adhered to in principle if not in actuality. Each operation should be in relational location to preceding and succeeding ones.

Planning a Foundry Lay-out.

In planning arrangement, the product must be considered. Melting equipment normally determines quantity output. The cycle of heats determines the turnover of floor space. Allocation of space or area for the various operations is dependent on the feed of all incoming materials and not on the outgo. This is vitally necessary to balance the production throughout. For example, the moulding department must absorb all materials, cores, patterns, flasks, sand, metal, and other accessories to produce rough castings in required quantity, variety and frequency. The cleaning room must absorb rough castings fed from the moulding department at the rate at which they are shaken out, and to clear them through at the same rate to shipping point. This principle of operation is vitally important if a fluid method of manufacture of castings is to be evolved.

The application of mechanical means of handling materials has become a science in many industries and is making some headway in the foundry; but the makers of miscellaneous castings have not embraced generally the full opportunities afforded by the use of handling equipment. The average foundry may employ profitably many varieties of materials-handling equipment, as may be evidenced by successful handling systems now in constant use in a number of foundries making a great variety of products.

Arrangement and Type of Equipment.

In the materials-handling phase of the foundry, arrangement will vary chiefly with the product, whereas the selection of the handling medium will vary principally with the range of size of work.

For example, continuous pouring prescribes a certain arrangement; pouring off at the end of the day, another. Open-hearth and electric-furnace practices each demand their individual plant lay-outs. The products of air furnaces also require definite arrangements in plan to meet the requirements of these practices, and the various non-ferrous products necessitate individual treatment is each particular point.

Size of Product.

The range of size of products, all the way from fractional lbs. to tons, of necessity will determine suitable application in mechanics to effect the movement of materials economically. This phase of the engineering problem can be roughly divided into two sections, as follow: (1) The heavy-weight classification that requires a complement of substantial overhead cranes, hoists, etc., in combination with other floor systems of handling equipment or devices, and (2) the average and lighter-weight classification that may use types of fixed conveying equipment without recourse to much overhead handling other than for metal.

Generally, the so-called average foundries predominate in the lower-weight classification, although quite a number may be considered to be combinations of the two general classifications. In such cases it is merely a matter of classifying the various weights of work into segregated areas and applying the most economical means to the handling of each classification, as being quite distinct from each other. These references are being made to the movement of all materials, sands, cores, moulds, metal and castings through all operations to completion.

SAND-HANDLING METHODS.

The requirement for uniformly-conditioned and economically-handled sands is common to all foundries, whether they make large or small work. Handling methods and devices for this commodity are chiefly questions of extent in outlay to handle the capacity and required conditioning for the particular grades of work. Sand handling plays a large part in foundry economy in a number of ways.

Primarily, sand-handling and conditioning systems of present-day design and method permit storage and conditioning units to be taken out of the operating areas, increasing the active floor area. The distribution of sands to moulding, when carried by overhead means, uses the ceiling, so to speak, which ordinarily has no value, being just the underside of a roof or upper floor. In this manner there is an increase of profit-yielding floor space. Such mechanisms provide continuous or periodic distribution to all moulding points, whether to moulding machines or to hand floors, and an ability to uniformly condition the total required quantity of sand and—highly important—to provide a gravitation feed of sands to flasks, the benefit of which is unquestioned when considering that a moulder will often shovel from 20 to 30 tons of sand daily.

Comparative Handling Costs.

A moulding requirement for 30 tons of sand hourly to be actually lifted for overhead distribution will require approximately five horse-power, with all fixed charges at, say, 10 cents per horse-power, or $4.50 per day of nine hours if run continuously. This more than equals the hand labour of ten men, putting it mildly. This hand labour would earn approximately $6.00 per day, or a total of $60.00 per day for hand labour, compared with $4.50 for mechanical elevation. The balance of power costs and fixed charges for the entire sand-handling and conditioning system can be compared to all other labour incidental to the work of getting the sand off the floor and prepared for re-use, otherwise.

Various methods of sand handling and conditioning may be employed to suit individual conditions. The system may be entirely centralised, from which central point all sands are distributed, or decentralised in several smaller units, any one of which may be installed singly or progressively to suit any plan of gradual development by easy stages.

A centralised system may be started with a limited number of service points and added to or extended periodically to suit growth. Also, such systems may be designed for handling and conditioning sands of varying kinds, and developed periodically and in varying grades to suit all types of work being made simultaneously.

Another economy effected by overhead sand delivery is the requirement for a smaller range of flask sizes. A few inches in dimensions either way in flask size does not materially affect the time required to fill with sand from an overhead source, the result being that the average work can be accommodated in a certain restricted range of sizes.

Fewer general sizes of flasks will permit of sufficient quantities of each size to suit an economical turnover and reduce the number of changes in size daily in producing a broad miscellany in sizes or weights of castings. The smaller range of flask sizes will greatly facilitate the work of planning and pricing jobs and will also simplify accounting of piece rates and payrolls.

CORE HANDLING.

The core department presents a wide range of handling methods and arrangement, the magnitude of which will be proportionate to production needs, size and variety of work.

For all purposes there should be an unimpeded lane of travel from core-sand mixers to all core benches or machines, and one that will not interfere with the making of cores or the movement of green or dried cores. Furthermore, the stages of operations should be arranged sequentially to prevent any cross currents of traffic.

Continuous core production may employ types of power conveyors or roller conveyors or combinations of both. The same applies in some cases to miscellaneous core production when large quantities are involved. Limited production at times profitably employs electric and hand-lift trucks, and pneumatic-tyred hand trucks equipped with springs are very handy for speedy core delivery.

The great element of labour saving in core production is in elimination of movement of both operators and products by a practical plan establishing a certain order for all operations. Economies in core costs can be obtained in the same proportion as in the rest of the plant by simplification in plan, and frequently at initial costs which are proportionately less.

Suitable storage areas for plates, racks and other accessories should be made easily accessible, but not to conflict with production in any way. A number of foundries have had splendid earnings in return for earnest and careful attention to the lay-out and design of their core departments.

MOULD STORAGE.

In practically all foundries, with the exception of those continuously pouring, there must be more or less storage of moulds to suit cycles of heats. To reduce labour and still have requisite storage indicates that such storage must be mobile, with the same storage content ordinarily. In cases of increased number of heats or splitting to secure a greater floor turnover and employing a specific pouring crew, the storage space may be reduced in extent.

To provide a mobile storage of moulds the roller conveyor has come into broad use for mould handling, enabling the moulder to load his finished section or mould directly at the moulding machine. Or, in the case of hand-made moulds, it enables him to produce them on the conveyor with easy discharge or movement to storage areas, and in an arrangement, suitable for high-speed, economical pouring.

Minimum Friction in Conveyors.

In order to move easily a great weight of product, the roller conveyor must provide a minimum of friction in operation. As the greater amount of moulding is done in green sand, and demands are being made for closer specifications and finer detail and finish in the castings, the mould-carrying conveyors must be precisely made to obviate destructive vibration and to be continuously maintained in this condition. They must withstand metal spillage and sand and contain some effective method of bearing preservation by preventing entrance of abrasive matter and moisture to the bearing elements.

There have been many attempts to employ roller conveyors in mould handling, but without success, due to lack of attention to these details. Development of roller-conveyor equipment specifically for foundry use has now reached a stage where any green-sand mould that will stand pouring can be rolled safely.

Roller Conveyors for Particular Purposes.

The great number of variations in plan for this type of equipment to suit local conditions will not permit explanation in detail in a general Paper such as this. However, the extent of such mould-carrying systems in governed by the required storage.

The various sizes and kinds of work are classified and segregated suitably to serve moulding points and at the same time be contiguous to metal for pouring. Often this general arrange-

ment can be so worked out as to concentrate the pouring and restrict it to comparatively small areas, because of the ability to move moulds in and out of the restricted pouring zones.

This method permits the employment of overhead means of carrying metal, with consequent greater speed of pouring, reduction of manpower, a high degree of safety and a simplicity of arrangement at moderate cost.

Floor Roller Conveyors.

Mould-carrying systems using floor roller conveyors have the advantage of flexibility and selective directional movement to suit the day's work, and provide easy means of access to a central shake-out point. They may be fitted to premises of peculiar shape and may be operated either longitudinally or laterally or both, with moulding points arranged in line for economy in sand-handling equipment.

Such systems may easily be altered in arrangement from time to time to suit changing conditions, or to improve the initial design in plan. This is easily accomplished, as no power applications are concerned and the equipment, being above the floor level, is quickly shifted.

Ease and speed of rearrangement will depend upon how well the system has been standardised with respect to dimensions, types and construction detail. A miscellaneous hodge-podge from many sources is not readily interchangeable.

FLASK STORAGE.

Location of flask storages is highly important. They usually are planned for adjacent location and easy accessibility to moulding points and to shake-out locations, in order that a circulatory movement of flasks can be facilitated, flasks going out as moulds, thence to shake-out, returning either direct to moulding points, or being routed through storage until required in moulding department.

As a discontinued size is retired to storage, the required size can be sent out to moulding simultaneously. Frequent changes in flask sizes can be made quickly to suit variety of work. These movements are timed in the planning to effect practically continuous operation on miscellaneous work, with only the necessary pauses to change patterns.

Flask storages are equipped with conveyors placed to suit orderly piling of flasks and handy for loading and unloading. Given a clean and dry storage area, this method will result in a great reduction in flask-repair costs.

Bottom boards, bands, jackets, etc., also are handled and stored in like manner. These methods apply, naturally, to materials that can be handled by hand. Heavier flasks and materials must be handled by the best facilities, but the same care in handling and relational locations will bring like economies.

SHAKE-OUT.

One of the most vital handling problems, purely as such, is the shake-out. This point should be easily accessible in its receiving and discharging features, and is a phase of foundry operations wherein much money can be saved. Location, function and mechanical detail will have much to do with its effectiveness as a labour saver.

This mechanism must be located so as to receive moulds with facility, for returning flasks by uninterrupted routes to moulding points or to flask storage, for discharging sand to sand-conditioning system, and for discharge of castings, if of medium sizes, direct to transit means for conveyance to cooling areas and cleaning department. Mechanical means for jarring out sand should be incorporated in the structure.

In short-time cycles of sand movement, dissipation of heat may be effected at this point by automatic tempering devices, suitably designed for types and quantities of sand. For some types of work it is expedient to connect the shake-out with an air exhaust system for the sake of good ventilation and cleanliness. A centralised shake-out may be equipped with power conveyor feed to speed up the operation.

Equipment Features.

Fast overhead hoists are frequently necessary to handle the larger moulds and flasks in conjunction with the feed and discharge features. At the discharge side, the shake-out should be served by a means of immediate transit to keep it clear of castings as shaken out.

In the average run of sizes of work a uniform type of steel container is practical, constructed to run on a substantial type of roller conveyor. The container will then be a movement unit for castings of a single type or kind when quantity permits, and will traverse the cleaning-room system as such, through to shipping point, and circuitously return empty to shake-out for next loading.

The container, as a movement unit, also will permit the use of a conveyorised cooling system, shaped to suit available area and so planned for cooling periods of varying length. This will form a continuous line or loop, with by-pass lines of sufficient capacity for the tonnage and time required.

CLEANING DEPARTMENT.

The cleaning department in the average foundry is sadly neglected when the search for cost reductions are made. Too frequently this part of foundry work is looked upon as a necessary evil and, in cost accounting, is dumped into burden. As a matter of fact, the regular operations of getting castings into saleable shape are just as important as processes, as moulding or pouring, and deserve the same attention in detail and exactitude of performance.

Labour in cleaning has need of the same expertness as in other operations and an equally well-planned system of process and movement. In many plants considerable improvement has been made in moulding and other directly chargeable operations, only to have the indirect cleaning burden of a high cost cleaning room prove a drag anchor in total costs.

The cleaning room too often is the happy hunting ground of the production chaser and the nightmare of the planning department. A properly-organised cleaning room needs no production chasers, nor need it interrupt production schedules.

Cleaning System Should Give Fluidity of Movement.

This section can be a smooth outlet to shipping by providing a natural fluidity of movement adapted to the required sequences of operations, just as is done in any other manufacturing industry. Through transit, in the required number of streams of movement, can be made that will reach all areas of operations independently of each other, in a manner not to block selective despatch to any desired point.

In this way any number of sequences of operations may be effected, maximum flexibility obtained, and the movement of product be made progressive towards the shipping point. These methods will make an even pace and will deliver finished castings at substantially the same rate as cast, or otherwise delivered by the shake-out.

Scales in the conveyor lines will assure weights desired for accounting or any wage-payment plan. Positive inspection can be secured by inspection stations at required points and through which inspectors only are permitted to clear the product in transit. Wasters will be thrown out in the early stages of process, resulting in earlier recast orders and the assurance of a good product delivered to the shipping room.

Balanced Cleaning Operations.

Such a system has the advantage of balance of operational function, the widest selectivity in sequence of process, the highest speed in transit and the lowest in costs and inventory.

The above references to cleaning operations might sound highly theoretical if it were not for the fact that the principles outlined have been put into practice in foundries making highly miscellaneous work, with resulting highly satisfactory returns on the investment. The value of the shorter manufacturing cycle can be estimated only intangibly in goodwill of the trade through earlier deliveries.

The systems and principles of foundry operation described above are fully adaptable to all practical foundry wage-incentive-payment plans. It will be found that such remuneration methods will be of great assistance in obtaining the most effective operation throughout.

Good Handling Methods Increase Production.

For purposes of comparison of ordinary production methods with well-ordered manufacture employing materials handling, planning systems, and coincidental wage plans, by employing moulding operators as moulders throughout the full day, the general increased production so far obtained has been better than 100 per cent.

Likewise, cleaning costs have been lowered between 40 and 50 per cent. Naturally, there will be variations, depending on many factors incidental to the individual plant. After fixed charges have been assessed against the investment in improvements, the earnings on these projects have run all the way from 80 per cent. to 200 per cent. annually.

For greater profits the average foundry needs a greater net earning per operated square foot of floor space, a shorter manufacturing cycle, a reduced inventory and a reduced pay-roll. These necessities can be procured by the methods described above.

These statements are based on experience and the continued operation in actual production of similar systems in a number of foundries, over periods of several years. Another great advantage of these systems lies in safety. There has been a decided reduction of accidents, with a consequent decrease in compensation insurance costs.

Foundry Progress and Labour-Saving Devices.

Looking into the future of the foundry industry, measured by any criterion of progress, it can be said with some emphasis that improvements in operations and costs are matters of urgent necessity and not choice, if the industry, as a whole, is to enjoy its rightful place in our modern arts.

The inception of this new life will be, unquestionably, through the general adoption and fullest employment of labour-saving devices in movement of the great mass of materials involved in foundry work.

If future earnings can be measured by results thus far obtained by such means, and if foundrymen will embrace these opportunities, the future will have splendid prospects. The remedy is available and the foundry industry can "write its own ticket."

Company Report.

A. & J. Main & Company, Limited.—Profit, £12,520; brought in, £5,118; depreciation, £3,000; dividend of 8 per cent. on the ordinary shares; carried forward, £5,180.

Second World Power Conference.—The Transactions of the Conference, held last June in Berlin, are to be published shortly in 19 vols. and an index volume. The special pre-publication price is £15, bound in cloth (£17 10s. after September 15, 1930). Separate volumes can be purchased (some at £1, others at £1 10s.) if ordered now, also Vol. XXI, containing the general reports in any one of the three official languages (English, French or German). After publication the prices of the single volumes will be £2 and £1 6s. respectively. The London agents are Messrs. Percy Lund, Humphries & Company, Limited, 3, Amen Corner, E.C.4.

Factories and Workshops in 1929.

REPORT OF THE CHIEF INSPECTOR.

The annual Report* of H.M. Chief Inspector of Factories and Workshops for the year 1929 states that at the end of the year there were 152,453 factories and 108,323 workshops on the register of the Department, being an increase of 2,921 factories and a decrease of 3,726 workshops as compared with the previous year.

Accidents.

The number of accidents reported has increased from 154,319 to 161,269, and fatalities have also risen from 953 to 982. The greatest number of fatalities in any one industry (133) occurred in the building trade, and the other industries most concerned were the metal industry (smelting, conversion, rolling, founding, etc.) 138, shipbuilding 95 and docks 90. The returns present no new features. As in previous years, only about 20 per cent. of the accidents were due to moving machinery, the remaining 80 per cent. being due to causes which, for the most part, cannot be prevented by physical safeguards. By far the largest proportion are attributable to causes such as falls, struck by falling body, handling goods and use of hand tools.

It is again very striking how many accidents have been due to sepsis, 17,586, of which 51 had fatal results, were attributed to this cause. This represents rather more than 10 per cent. of the whole of the reported cases, a proportion which corresponds almost exactly with that of the previous year. Such figures can only suggest that there is still great neglect to make adequate use of the first-aid appliances which are now compulsory in every factory.

Safety Organisation.

It was decided last year, after discussion with representatives of the various Employers' Associations, not to proceed further for the time being with the Draft Safety in Factories Order in the case of those industries where assurances were given by the Associations concerned that they would themselves take up the matter of safety organisation energetically with their members, and in the Report last year the Inspector gave a list of the Associations from which such assurances had been received. It was not possible at that time to do more than record the fact that effect had been given to those assurances, by the issue of circulars, embodying in many cases model schemes which had been issued by the Associations to their members. It is now possible to review the results. The following table shows the number of works which would be affected by the Order, and the number in which safety organisations have or have not been established:—

Industry.	Works affected.	With safety committees or other forms of safety organisation.	Without safety committees or other forms of safety organisation.
Blast furnaces	58	52	6
Iron and steel mills ..	307	237	70
Heavy engineering ..	293	233	60
Iron founding	305	191	114
Shipbuilding ..	166	136	30
Total ..	1,129	849	280

It will be observed that in the great majority of cases safety committees or other organisations have been appointed, and there can be no doubt that there has been a big step forward in the Safety First movement. At the same time the reports of the inspectors show that there is great variation as regards the efficiency of these organisations, and there are far too many instances quoted where lack of interest, lethargy and laxity have been observed.

Transmission Machinery and Crane Accidents.

Despite the great attention paid to the question of safeguarding transmission machinery, no decrease can be shown in the number of reported accidents. There were 211 accidents due to shafting as compared with 207 in the previous year, but fatalities have fallen from 35 to 24. Accidents caused by belts, ropes, pulleys and gearing amounted to 1,233, as compared with 1,111 in 1928, and in this class fatalities have increased from 12 to 23. Many of these cases have been attributable to the usual causes—shipping and unshipping belts, approach to overhead shafting for lubricating and even for cleaning purposes, allowing men to carry out such jobs as lime-washing in proximity to revolving shafting, allowing belts to ride loose upon revolving shafting, and so on.

Ninety cases of crane and derrick failures were reported, an increase of 15 per cent. on last year's figures. These caused 19 fatal and 61 non-fatal accidents. The number of fatal accidents is the same as in 1928. In 23 instances no personal injuries resulted. The Report contains a statement showing the classes of cranes and the parts on which failure occurred.

Fumes and Gases.

The number of carbon monoxide cases is higher this year than for many previous years, the reason being due to cases which have occurred at a large works where water gas is used. Accidents from carbon monoxide are often very difficult to avoid, and while the number of fatalities is not high, the possibility of many non-fatal accidents becoming so is apparent. Accidents of this class can only be avoided by the greatest care and supervision.

There were 25 cases of gassing reported at blast furnaces, 5 of which were fatal. Of these, 12 (1 fatal) were due to escape from gas mains, valves, water seals, etc.; 5 (2 fatal) to escape from the furnace; 5 (1 fatal) to charging the furnace; and 1 fatal case to escape of gas into a boiler which deceased was cleaning out.

There were 21 cases of coal-gas poisoning (1 fatal) reported, 3 were due to removing oxide from the purifying boxes; 3 to repairing a gas main; 2 (1 fatal) to repairing inside a gas holder; 3 to escape from leaky pipes, valves, etc.; and 2 to escape from gas jets.

Electrical Accidents.

The Senior Electrical Inspector reports that the use of electrical energy in industry continues to extend rapidly. For the five years, 1910 to 1914, the average number of accidents was 403, actually greater than during the last five years, although the use of electrical energy was probably less than a fourth part of that in the latter period. The high-water mark was reached in 1913 with 512 accidents. It is evident that whilst the average yearly number of accidents is less than it was fifteen years ago, it is now slowly rising, as is only to be expected. Compared, however, with the rate of increase in the use of electricity, it is a diminishing quantity.

The primary injuries from electrical accidents are shock, burns and eye-flash. Of the 139 direct-current low-pressure accidents the main injuries were shock 14, burns 113, eye-flash 12, and of the 141 alternating-current accidents 97 were shock, 42 burns and 2 eye-flash. Of the direct-current accidents (250 volts or less) none was fatal, whilst of the alternating, 21 proved fatal.

* H.M. Stationery Office, Adastral House, Kingsway, London, W.C.2. (Price 2s. 6d. net.)

Has Tin Bottomed?

By "Onlooker."

Many a speculator who has burnt his fingers badly in bulling the tin market during the past few months is asking himself whether the bottom of the prolonged fall has at long last been reached. To this query one can answer with a fair amount of certainty in the affirmative, but from that it does not necessarily follow that the market is ripe for a rise. For the first time in many months, total visible supplies showed a reduction at the end of July, a very small one, it is true—some 250 tons—but, nevertheless, a step in the right direction. This total, however, remains at more than 42,000 tons, or very nearly twice what it was twelve months ago, and compares with about 18,000 tons at the end of July, 1928. At that time stocks in official warehouses in this country stood at 3,000 tons, a year later this was trebled, while at the moment our reserves are but little short of 24,000 tons.

Although showing a declining tendency, the price of tin was kept above £200 up to September last year, but from that point onwards there was a steady decline, until it looked as if the quotation were fated to fall below £130. This, however, was saved by an announcement made by the tin producers that agreement, partial but nevertheless far-reaching, had been consummated on a policy of curtailment of output which would cut down the 1930 production by some 30,000 tons. While, as stated above, acceptance of the curtailment programme was not universal, it is evident that the majority of mines recognise their inability to earn profits at the existing price level and are prepared to fall into line with any scheme which will ensure them a more lucrative return for what is after all a wasting asset. Costs vary considerably in different parts of the world, and, while it may be true that a comparatively small quantity of tin can be produced at a cost of only £80 per ton, there are other mines whose profits vanish almost entirely when the quotation falls below £200. Recent trading results have shown that, on the whole, existing quotations are uneconomic from the producers' viewpoint.

The main fact in tin's downfall has been the very marked falling-off in American consumption, coupled, of course, with a reduction in demand from other parts of the world. To some extent production has been cut down, but on the whole has so far shown very little falling-off compared with 1929, so that the slump in consumption has had the inevitable effect of putting up by leaps and bounds the reserves of unsold tin. Stocks in the United States, which normally stand at about 3,000 tons, stood at nearly 8,000 tons at June 30, so that British and American stocks combined exceed 30,000 tons, a total equal to more than two months' world consumption, and certainly not encouraging to those who look for a rapid recovery in values.

Of an improvement in the tin situation there is, however, some sign, for, in addition to quite a fair demand in this country, American consumers have latterly showed more interest, and there is a suggestion, too, that the automobile industry over there is displaying a little more animation. The betterment, such as it is, cannot be hailed with much jubilation, for statistically the tin situation is very adverse, and at the best months and months must elapse before this can right itself. In the world of metals, however, "coming events invariably cast their shadows before them," and tin values will improve long before big stocks and excessive visible supplies have shrunk to normal proportions.

Ropes and Belts.—A 2-in. dia. cotton driving rope will give approximately the same power as a 12-in. single leather belt, each running at a common speed.

Moulding a 40-in. × 16-in. Sink in Green Sand.*

By H. Magdelenat.

Fig. 1 shows the sink as a finished casting having two side draining boards, a syphoid plug-hole on the right, and three lugs for attaching to walls.

Fig. 2 shows the moulding box in two parts with accessories. (A) is the bottom part, so called as it constitutes the lower half when the mould is being poured; this corresponds to the top part of the casting. (B) is the top part, *i.e.*, the part which is at the top during the pouring. In this illustration the two parts are shown as follow: (A) placed on the plane of joint; (B) placed on the pouring plane. (To represent the two parts in their actual position at the moment of casting (A) must be imagined as placed over (B) and the whole turned over.) (C) shows the wooden patterns of the two runners, and (D) the sand core of the plug-hole.

Fig. 3 shows the pattern placed over one of the two parts of the moulding box, termed "bottom part" (pouring position). Note the four pins riveted into the lugs of the box and piercing the pattern (two of the lugs are seen on the front edge of the pattern); the circular patch opposite the plug-hole, enabling a sink to be moulded with right or left plug-hole with the same pattern; the wooden pattern for taking the plug-hole core; the position of the runners.

Fig. 4 shows the pattern placed on bottom part (in the pouring position this part is turned over on the part shown in Fig. 3).

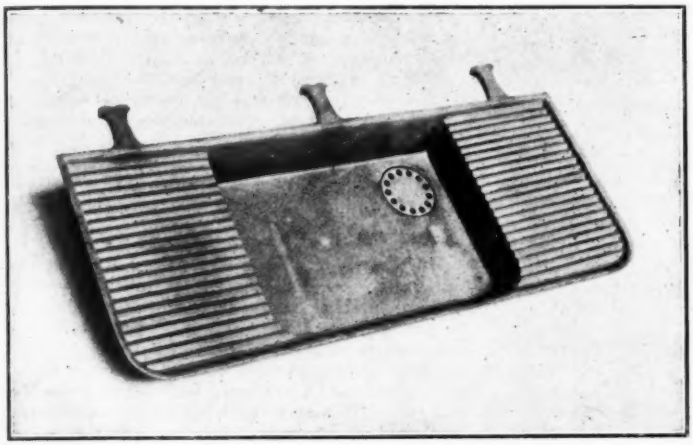


Fig. 1.

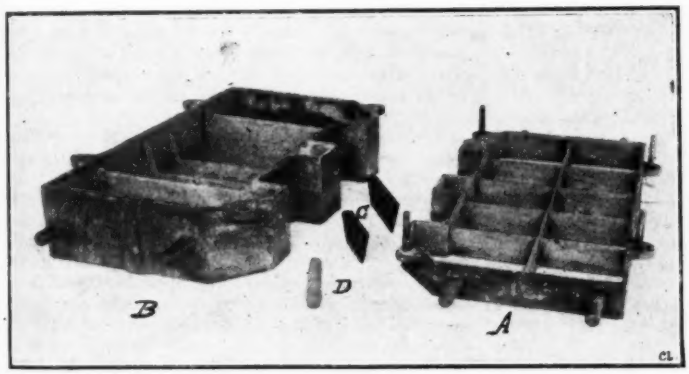


Fig. 2.

Method of Moulding.—The actual moulding comprises eight operations as shown below, with the corresponding times required:—

Detailed Operations.	Time, min.
No.	
1.—Registering the pattern between the two parts of the moulding box ...	2.13
2.—Ramming bottom part and turning over	6.51
3.—Placing gates, the piece stopping the unused plug-hole and the riser ...	2.95
4.—Ramming top part	8.00
5.—Lifting top part, drawing the pattern and cleaning it	1.43
6.—Fitting top and bottom parts together	3.50
7.—Blacking and smoothing	4.21
8.—Removing the runner plugs, coring up and assembling mould	5.20
Total	33.93

To these operations must be added, for the complete production of the article, the time taken in pouring, stripping, preparing the sand and core-making, viz., 8.59 min., which brings the total time up to 42.52 min.

* Part of a Paper presented at the Annual Convention of the Institute of British Foundrymen, on behalf of the French Foundrymen's Association, of which the author is Vice-President.

The American Manganese Producers' Association has asked the United States Government to place an embargo on Russian manganese ore.

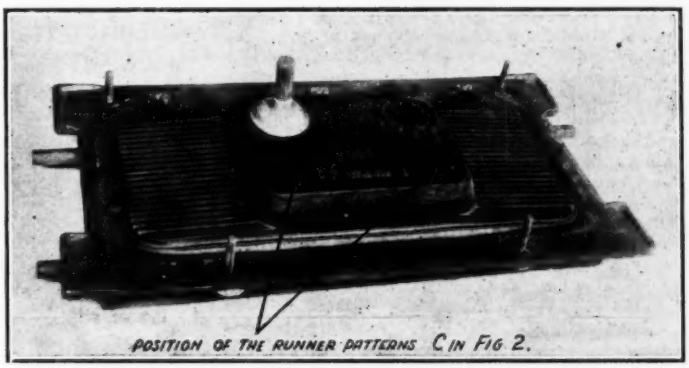


Fig. 3.

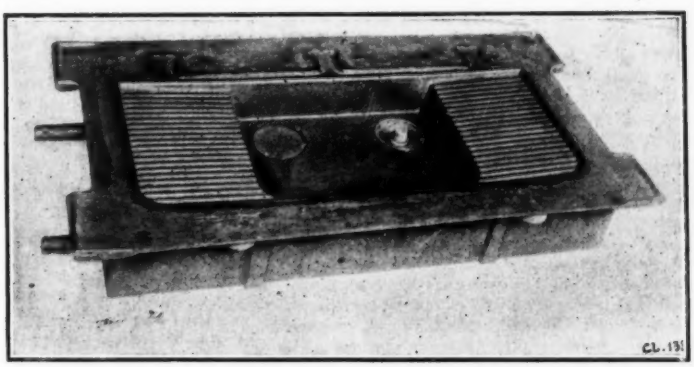


Fig. 4.

The Heavy Steel Trade.

Sir A. Dorman on Modern Conditions.

Sir Arthur Dorman, chairman of Messrs. Dorman, Long & Company, Limited, contributes an open letter to the current issue of the Tees-side Chamber of Commerce "Journal," in which he comments on the charges of inefficiency made against the British steel industry.

Statements are freely made by interested competitors, and repeated by ill-informed criticism at home, that the heavy steel industry of Great Britain is inefficient in its equipment, in output and its method of conducting business. In this connection, Sir Arthur points out that Tees-side has maintained a steel output considerably higher than before the war, in spite of the loss of production due to the diminution in shipbuilding requirements. And it is not only in output that the heavy steel industry of Tees-side has maintained its position. Modern engineering calls for a material, homogeneous in composition and structure, and capable of continuously resisting strains and stresses of ever-increasing intensity. Close control of the methods of steel production and careful supervision of the processes of manipulation have enabled them to keep, not only ahead, but in front of this demand for higher quality and greater durability. In the vital parts of modern structures British steel alone fulfils these exacting requirements.

His own company is engaged in building the great harbour bridge at Sydney. They could not have undertaken this great structure without the knowledge derived from testing to destruction component parts of the structure, and the certainty that they could produce a steel so uniform in character that it could be relied upon to give in practice the results attained under test. Wherever the entry into markets is not prohibited by high tariffs or trade disturbed by inner discontents, the heavy steel industry of Tees-side has more than maintained its position. This position, Sir Arthur concludes, is based upon sound craftmanship, careful manufacturing methods and the use of plant and equipment which, if not upon the immense scale of America and the Continent, is well suited to deal with the raw materials from which our steel is made.

D

Foundry Personnel Training.

DR. INGALL'S CALL FOR CO-OPERATION.

Dr. Ingall's Paper,* presented to the recent Middlesbrough conference, constituted an important contribution to the subject of training the rising generation of foundrymen. The discussion revealed that no unanimity of views exists because of the regional and vocational requirements differ so largely.

The President (Mr. F. P. Wilson), who opened the discussion, said that the scheme which Dr. Ingall had outlined may ultimately apply to a wider area than Tees-side. At present it may be the only course of its kind in the country, but other districts may follow suit, and that would be all to the good. They as an Institute may be able to help to bring the scheme to a successful conclusion. He wished to support Dr. Ingall's plea for the co-operation of the employers.

German Conditions.

Mr. J. A. Smeeton said that in Germany the science of the foundry had been developed to a very high degree. Modern machinery which would make a mould large or small was extensively employed. Foundry work was a science, and founding must be scientific. Scientific mixing had been developed largely in the last few years, whilst higher qualities of iron were being demanded, and the foundryman must have metallurgical knowledge, and he must be able to apply it. He must be a clever engineer and an erudite metallurgist, whilst he required a training as long as that of a doctor or a lawyer, but the industry would not pay the cost.

The visiting of foundries by students was carried out very largely on the Continent. In many colleges the students spent two weeks each year in visiting foundries and two months each year in practical foundry training. German industry supported the students financially, made grants to the Universities, both financial and also by gifts of machinery and plant. If, for example, a new type of furnace was introduced, the makers presented such furnaces to the Universities and Colleges. The students thus become familiar with all types of plant, and at the end of their course they were expert foundry managers. They were valuable men, and were fairly highly paid. It was useless to put such men in jobbing foundries because such plants would have no use for their knowledge.

In this country we made the finest castings in the world, but we made them on the hit and miss principle. Foreign-made castings were coming into this country at a low price; they were not subsidised but were produced by scientific control. Unless we in this country equipped our foundries scientifically, the foundry business would go abroad. In response to Dr. Ingall's appeal for co-operation, he said that he was prepared to place six students per year for five years in German foundries for a period of three months' training. (Applause.)

Practice First—Science Later.

Mr. A. Campion congratulated Dr. Ingall for bringing the Paper before them. The Institute had given a good deal of attention to the training of foundry youths. The author had recognised that there were two distinct classes to cater for, namely, the craftsman and the manager. The National Certificate Scheme sponsored by the Institute and conducted by the Institution of Mechanical Engineers would provide for the needs of the "professional" students, and the Institute was now concentrating upon training of craftsmen. Most foundry boys had no preliminary scientific training, and the failure of some foundry classes was due to this having been forgotten. A youth frequently spent two or three years in preliminary studies before he got to the work of the foundry, and he lost interest.

He suggested turning the course upside down. He would commence with descriptive foundry work, and would teach the scientific principles afterwards. It must be remembered, however, that one could not make moulders in a technical college. The important point was to get the interest of the students, who will then usually want to extend their knowledge. When they find that certain things depend upon certain principles they want to know something about these principles. Such a course may be described as "foundry science," and mathematics could be called "foundry calculations." Some of the remarks about the low status of foundry apprentices were no longer true, as there had been a marked change in recent years.

Keighley's System.

Mr. W. H. Poole expressed his appreciation of the Paper, and said that in his own district a few years ago the classes in foundry practice were very poorly attended. He was approached and organised classes in his laboratory. He found he could get a good number of students by giving the classes a practical bias. About fifty students attended these classes each week. Visits to works were an important part of the work. He would be honoured if he could be of assistance to Dr. Ingall. Incidentally he noticed that Dr. Ingall had not included the Keighley classes in the list of schools in the Paper.

The average old-time foundryman was afraid that the chemist was going to push him out of his share of the credit. It was the duty of the metallurgist to show that such was not the case. It was the practical application which counted, and craft skill was of great importance. The practical foundryman should show more friendliness to the technical man. Both types of workers should co-operate, and they were looking forward to the time when both sides would find that they had one common object.

Recruiting the Boys.

Mr. John Cameron (past-President) drew attention to another aspect of the problem, that of the supply of boys. It was desirable that someone should go to the boys and give them some ambition. The boy could be asked if he wanted to rise to be a foreman, and even if he wished to own a foundry of his own some day. If the foundry were not too big, the employer could help considerably by keeping in personal touch. He supported Mr. Campion's remarks, and expressed his appreciation of the inspection of the Constantine Technical College, which was one of the best equipped in the country.

Mr. T. W. Markland said he was delighted that Middlesbrough had taken such an important step in foundry training. As a teacher of a foundry class, he found that boys were interested if they were shown that the more they understood the technical side, the better would they understand the practical side. At the end of last session his boys had asked that the class be continued longer. Middlesbrough was proceeding on the right lines to arouse the interest of the boys. He had visited the works in his district and had talked to the boys with a view to arousing their interest.

Avoiding Wasted Effort.

Mr. J. G. Pearce said that the scheme outlined in the Paper was of great interest, and the information given would be of great value to the Institute's Education Committee. The co-operative scheme at present in operation at Middlesbrough was of considerable interest. It was impossible to consider Dr. Ingall's proposals apart from those before the Institute's Education Committee at present. How far would the scheme fit in with the broad development which is taking place in connection with the National and Craft Certificates? He did not see eye to eye with the author regarding the disappearance of the skilled moulder. The new type of foundry was calling for a different type of man—of a higher and not a lower type.

Was Dr. Ingall satisfied that a course of the type he has in mind could be run with the present staff of the college plus one fully-trained foundryman? He doubted if there was room for more than one course of the kind in this country; the numbers would not be sufficient for more than one school. There was nothing to prevent other colleges embarking upon such a scheme, and in a few years time there may be a number of centres desiring to provide similar courses, and many of them would probably be inadequately staffed. The interest of the Institute of British Foundrymen and the Board of Education should be enlisted in order to avoid duplication.

Mr. A. Sutcliffe said that in the present day foundry was for men who could give a large production. Many employers demanded only muscle. He asked Dr. Ingall if the boys attending the present day course at Middlesbrough were paid their wages by their employer when attending classes in the day time.

Craftsmanship and Written Papers.

Mr. C. A. Otto expressed appreciation at the concise manner in which Dr. Ingall had grasped the position respecting the foundry, and whilst he said he would like to take exception to the assertion made by Dr. Ingall that the foundry workers generally were of a low standard of education, but, after some little experience, he was bound to admit the truth of the statement. He asked Dr. Ingall if the cause of this lower standard was due to the fact that engineering apprentices were forced to attend Evening Classes immediately on commencing an apprenticeship, while similar pressure was not customary with foundry workers, and, when the desire to attend classes arose some two or three years afterwards, they were at a disadvantage educationally in comparison with engineering apprentices.

In connection with the two types of examinations mentioned by Dr. Ingall, he urged that anyone who aspired to foremanship or managerial position in a foundry should be able to produce sound castings if necessary, and it appeared to him that the National Certificate Scheme contained that flaw. For this certificate the training did not give any opportunity to test the students' ability to produce sound castings, though it did give them opportunities to answer questions on paper. He spoke on this matter feelingly because some of the students who had been under his direction were expert craftsmen, and could produce good castings of intricate shape, but could not answer questions adequately. Others were able to answer questions on paper extremely well, but were unable, except perhaps on rare occasions, to produce castings commensurate with their knowledge of the subject.

AUTHOR'S REPLY.

National Scheme Criticised.

Dr. Ingall, in the course of a brief oral reply, thanked Mr. Smeeton for his offer to provide facilities for future full-time students of the Constantine College to work in German foundries during their vacations. That offer went beyond his highest hopes, and it was a tremendous asset; he was, indeed, grateful.

Replying to the question raised by Mr. Pearce as to how the scheme at the College would fit into the City and Guilds Craft Scheme, and into the National Certificate Scheme, he said quite frankly that he did not know. It was quite likely that the scheme would fit gradually into

* Published in our issues of June 19 and July 3.

the City and Guilds Craft Scheme, but he was seriously doubtful about the National Certificate Scheme. This latter statement might sound rather like heresy, he supposed, and it was merely a personal opinion, but he was not too happy about the National Certificate Scheme so far as foundry work was concerned. It seemed to him that to start with it placed far too much emphasis on the engineering side. The training under the National Certificate Scheme had to cover a period of three years, and three subjects were to be taken in each year, making a total of nine subjects; the students were only allowed to take their own particular subject during the last year, so that they were only dealing with foundry work proper in one out of nine subjects, and he did not think that was enough. After all, the bulk of foundry work was concerned more with metallurgy than with engineering; inside the foundry one was concerned mainly with foundry sands, refractories, and the melting and casting of metal, and all those matters were metallurgical rather than engineering. Further, he did not think that the personnel available in the Middlesbrough district was likely to be sufficient in numbers to be able to support the present National Certificate Scheme for the next four or five years. He did not wish to throw cold water on it; indeed, he regarded it as representing a step forward, but he was very unhappy about the scheme in many respects, though probably adjustments would be made as time went on.

Duplication of Effort.

He felt very much as Mr. Pearce did with regard to the duplication of courses, *i.e.*, that any serious attempts to duplicate such a course as this in a number of other centres would simply ruin the whole scheme. He would not like it to be thought that those at the Constantine College wished to be selfish. They did not, but he wished to have the opportunity to learn by experience. His personal feeling was that in the future there would be probably two centres, one to serve the North and possibly some of the Midlands, and another to serve the South Midlands and the South later on, but at the moment he felt that experience should be gained at Middlesbrough before any attempt was made to form other centres, in order to ensure that those other courses were run on the right lines.

Replying to the question concerning the conditions under which foundry lads went into other foundries than their own for experience, he said that they went during working hours, and their wages were paid while they were there. The lads had been circulating from foundry to foundry on Wednesday afternoons.

Replying to Mr Otto's point about answering questions, he confessed that he was rather unorthodox in certain respects concerning examinations, so that perhaps he had better not give himself away. However, not too much stress was being laid on examination papers in the courses at the Constantine College.

He emphasised that the authorities at the Constantine College did not regard what they had done as representing finality. They realised that the part-time course and the proposed full-time course were experimental. No doubt they would make mistakes, and perhaps some very bad ones, but they hoped to learn much by such mistakes. One of the reasons why he had presented his Paper was that he had thought that what had been done and what had been arranged to be done at the College would be of interest to the members of the Institute, and if the members could guide the College authorities so that they might be able to avoid mistakes, they would be grateful; they did really want the Institute's co-operation and guidance.

The President expressed thanks to Dr. Ingall for his Paper, and said the Institute would welcome further information from him at a future Convention, when he had had more experience of the working of his schemes; the Institute would be glad at some time in the future to hear what were the practical results achieved. The President also reminded the members that, if they could offer facilities for students to enter their foundries during vacations, they would help the schemes very greatly, and he asked those who could provide such facilities to inform Dr. Ingall.

Mr. T. G. Bamford (Member, County Technical College, Wednesbury) wrote that he was keenly interested in watching Dr. Ingall's successful application at Middlesbrough of ideas which the writer knew had been germinating in the author's mind for some years.

The old traditional routine of the foundry is passing, and educationists must face the problem of training suitable personnel. This is well-recognised by Continental manufacturers, and the works school has emerged as an integral factor in the training of moulders and pattern-makers by large German and Swiss firms. Dr. Ingall recognises clearly that the technical college cannot replace but must be supplemented by contemporaneous training in the foundry. While there are tremendous difficulties in the way, surely it is along these lines of co-operation between industry and technical colleges rather than by the development of works schools acting independently of the education authority, that the needs of the British foundry trade can best be met.

One large firm in this country, contending that college engineering courses are suitable only for designers, is running its own works school in order to meet the needs of the 80 per cent. of its employees who are manual workers. The grievance expressed by this view is being met satisfactorily through the provision of courses in production-engineering developed in full sympathy with the industry.

Dr. Ingall is blazing a trail along which manual workers of suitable standard can be trained for the foundry, and the industry can be assured of a supply of men capable of meeting the exigent demands which will be made upon the technical knowledge of its managers. Education authorities elsewhere must also be prepared to make bold experiments, and foundrymen must meet them with broadminded co-operation.

The author's Paper is dealing with the training of foundrymen, and naturally makes little reference to the foundry engineer. The author believes, however, that modern engineering developments, with its attendant repetition castings and machine moulding, has created anew a demand for the foundry engineer concerned with the lay-out of foundry plant, upkeep of machinery, and so forth. For such men the usual training given to major engineers in technical colleges is deficient by the omission generally of both metallurgy and of foundry science.

The new provision made by the Institute for the endorsement of national certificates would seem to recognise this fact. Metallurgy already forms an integral part of the major engineering course at Wednesbury, and provision is being made whereby men who have already taken the National Certificate may supplement their training in such manner as to secure the endorsement of the Institute of British Foundrymen and of the Institute of Mechanical Engineers.

Hardening Steel with Nitrogen.—At the U.S. Bureau of Standards a study of the alloys of iron with nitrogen has been made, which helps to explain the new process of nitriding steel. It is not practicable to harden ordinary carbon steel with nitrogen on account of the insufficient hardness and brittleness of the surface layer in nitrided iron, and special alloy steels containing aluminium, and sometimes molybdenum, and chromium are used. However, before a study of the alloys of nitrogen with these alloy steels could be undertaken, the simpler case of the alloys of nitrogen with pure iron had to be studied. Pure iron appears to form three definite compounds with nitrogen, containing respectively 4, 6 and 11 per cent. nitrogen. The intermediate compound containing 6 per cent. nitrogen appears to be the one to which the hardness of nitrided iron is due.

Company Meetings.

Bengal Iron Company, Limited.—Mr. W. Turner MacLellan (chairman and managing director), who presided at the annual meeting of the Bengal Iron Company, Limited, said that the working of the merger agreement with the Indian Iron & Steel Company, Limited, had been satisfactory. In regard to the future it was difficult to give any forecast, but they were busier in their foundries this year than they were last year at this time. The pig-iron market, however, was depressed at the moment. Financial stringency caused the Government of India to curtail railway expenditure—on which they depend to a large extent for orders—and this had been aggravated in the last few months by political unrest in many parts of the country. Until stability returned there was not much chance of business resuming normal proportions. The proceedings terminated with a vote of thanks to the chairman, directors and staff.

Duffield Iron Corporation, Limited.—The annual meeting of the Duffield Iron Corporation, Limited, was held in London on July 31. Sir Philip Dawson, M.P. (chairman), who presided, said that the progress made during the year had confirmed the opinion he previously expressed as to the value of the processes and patents owned by the company. From the results already achieved, he was satisfied that a wise course was adopted in deciding to instal a complete productive unit. Mr. F. L. Duffield (managing director) said it would be idle to refute that reaching the present stage of proving their success had taken longer than anticipated. Various problems had arisen, but he was glad to say that none of them had reflected upon the ease with which their theoretical conceptions could be developed in commercial practice. Mr. Duffield then dealt at some length with the various problems and difficulties which had had to be dealt with, and outlined the progress that had been made to date. In conclusion, he stated that one further stage would complete the technical development and commercial demonstration. They could then face the industrial and financial interests of the world, not with a suppositious case respecting their details of costs, but with undeniable facts of the costs of production from the ore face to steel.

Contracts Open.

Clacton-on-Sea, August 18.—Pumping plant, for the Urban District Council. Messrs. John Taylor & Sons, Caxton House, Westminster, S.W.1. (Fee £5, returnable.)

Hull, September 18.—Pump, etc., for the Electricity Committee. Mr. J. N. Waite, city electrical engineer, Sculcoates Lane, Hull. (Fee £2, returnable.)

Johannesburg, August 28.—50 cast-steel gear wheels and/or alternatively 50 forged-steel gear wheels, and 50 pinion wheels for tramcars, for the City Council of Johannesburg. The Department of Overseas Trade. (Reference A.X. 9,969.)

Johannesburg, September 15.—Three overhead travelling cranes, for the South African Railways and Harbours. The Department of Overseas Trade. (Reference A.X. 10,008.)

Johannesburg, September 22.—10-ton and 6-ton travelling cranes, for the South African Railways and Harbours. The Department of Overseas Trade. (Reference A.X. 10,009.)

Sandown, September 3.—Pumping plant, for the Urban District Council. (Fee £2 2s., returnable.)

South Africa, August 23.—Two centrifugal pumps, etc., for the Paarl Municipality. The Department of Overseas Trade. (Reference A.X. 9,996.)

South Africa, August 23.—10,000 ft. of 6-in. cast-iron pipes, etc., for the Paarl Municipality. The Department of Overseas Trade. (Reference A.X. 10,000.)

South Africa, September 1.—Nickel-chrome steel, for the South African Railways and Harbours. The Department of Overseas Trade. (Reference A.X. 10,007.)

Rustless Steel for Aircraft.—According to an article in a recent issue of "Steel," corrosion-resisting steels are being employed for structural and engine parts in aircraft. No real standardisation has taken place, because development is still in the experimental stage.

XUM

Moulding Marine-Engine Castings.

Out-standing amongst the Papers presented to the recent Congress of the British Institute of Foundrymen at Middlesbrough was Mr. Scott's Paper dealing with the moulding of heavy marine-engine castings. The discussion brought out a number of points of real practical interest.

Standardised Chaplets.

Mr. F. J. Cook (past-President) said that those who felt that the Institute was somewhat inclined to favour Papers of a too-technical nature and an absence of practical ones, would find the Paper under discussion after their own heart. This Paper, taken in conjunction with Mr. J. Smith's Paper, printed in the 1908 "Proceedings," would provide a very useful guide over a wide range of large and medium castings of a complicated nature.

The author had been very courageous in giving such full details of methods and times taken to produce the several articles, and if any member had better methods or could show better times for making, the author was fully entitled to have them pointed out. The question of chaplets was quite important and one that the newly-formed technical Committee might well take in hand with a view to bringing out some form of specification as to suggested shapes, sizes and materials.

Contraction and Hot Spot.

Mr. Scott had pointed out in connection with Fig. 24 an apparent anomaly, inasmuch as the metal supporting tube had reduced in length under heat-treatment instead of growing. This may be due to the fact that it was in contact with a very hot spot in the core, and probably the weight of the core would tend to compress the tube when heated. One special point the author had not mentioned in connection with this tube was the benefit derived by the tube allowing a ready passage of gases from a part that was, indeed, a very hot spot, and by so doing helping to prevent what otherwise might be a source of detriment to the casting.

The author had referred to the necessity of careful attention to the composition of the materials employed, and the proper refining of the iron where semi-steel is employed. This point deserves special emphasis, as its importance was not generally recognised. The analysis of the iron given for the several parts would be most useful to many members, and the author was to be congratulated on producing and presenting a Paper so full of practical and useful information.

Cheapness or Quality.

Mr. A. R. Bartlett said that the Paper was extremely useful and interesting, and that Mr. Scott deserved the thanks of the meeting for coming forward and so ably describing in a thoroughly practical manner the methods he applied in making high-class castings for Diesel and turbine work. He noticed Mr. Scott said that, owing to the complicated design of many of the castings, much skill and forethought were necessary in the production of the main castings. He would like to ask Mr. Scott if, when considering the method of moulding to be adopted, did he find it essential to consider the cheapest method of moulding, or did he adopt the method which would give the best results. Personally, he considered it was imperative that the duties the finished casting had to withstand should be the point to be considered, and the moulding should be done accordingly even if the initial cost were greater.

Importance of Core Iron.

A point of especial interest was the most important one of how core irons should be made. Mr. Scott had shown a design of core iron with which he entirely agreed. It was obvious that the toeing of the grid was essential, as there was a greatly reduced resistance to contraction with the type of core iron shown as against a frame grid where the whole surface would oppose contraction. Mention was also made by Mr. Scott of the need for employing a capable man for this job. Personally, he always arranged for the charge hand to make any core irons or similar tackle. In his opinion, this was the essential guide to all the men engaged on the job as to how it is to be carried through.

Another important point raised was the making of vents. This was admittedly an essential feature. They all know what confined air would do, and the strength of compressed air was also well known. He thought that this had a great bearing on the subject of the grids before mentioned, as a grid that was wrongly made or too heavy in section reduced the available space for venting.

Mr. Scott's observation on the loam shelling off heavy loam cores, especially those struck up on brickwork, was of paramount interest, and he agreed with him that the grinding of the loam in a heavy mill was a mistake, resulting, as Mr. Scott stated, in smashing of the grain size. Over-grinding was a bad feature, and sufficient time thoroughly to knead the sand to the consistency required should never be exceeded. Another reason for this steaming-off of the face of the core, or mould, was that the core was not sufficiently vented. He always had the face of every loam job pricked with a needle wire, after the core or mould had stood long enough to get stiff. These small vents were pushed right through the loam to the brickwork, the brickwork having fine ashes always put between. This liberated the steam and helped to avoid the stripping mentioned by allowing a free escape of the steam.

Standard Pattern Colours.

Mention had often been made of the necessity of having some standard method of colouring patterns, to distinguish the machined parts and also the parts where cores had to be placed. They all know how difficult it must be to receive a pattern, especially one from outside their own organisation, that had no definite colouring to denote these parts. This was even more important when no blue print or drawing was sent with the job. The client frequently had to be communicated with, and very often they had to send a representative to clear up the matter, often at a considerable cost. This could be avoided if there was a standard system of colouring throughout the industry, and then everyone would know what was meant and what was required. Could Mr. Scott state if he had definite colourings for the various parts of his patterns, and what they were?

Mr. Scott mentioned the cost of making some of his jobs. He congratulated Mr. Scott on his prices, and agreed with him that moulding and coremaking must run parallel, or there was a likelihood of the one section hanging back to the speed slower section.

Mr. F. Hudson, after complimenting the author in his excellent Paper, discussed three points:—(1) Sand preparation, (2) drying of loam jobs and (3) chaplets.

Sand Preparation.

As all the castings referred to in the Paper were made either in loam or dry sand, the physical tests shown in Table I would have been of more value if they represented or had shown a comparison between the actual dried strengths and permeabilities of the sand at the moisture percentages used for moulding or strickling, as the case might be. Furthermore, it was not feasible to assume that the floor sand used was equal to the facing sand, for the reason that the moisture percentages were not the same. At the same time, whilst two sands may give identical tests green, they may be totally different after drying. It would be very valuable if Mr. Scott could test out his sands as suggested for incorporation in the "Proceedings," so that foundries using different sands could obtain a correct comparison with their own practice.

Drying Loam Work.

In regard to the second point, relative to drying loam jobs, he was inclined to disagree in regard to the shelling as being caused through lack of permeability through the use of heavy rolls. Even at their best, loam jobs were comparatively impermeable when compared with, say, green-sand work. Furthermore, loam contains from 14 to 24 per cent. water, which had to be removed. If care were not taken during drying the large evolution of steam would cause shelling, regardless of permeability. Shelling could be completely cured by correct drying. If a thin hard skin were formed, surely that was an indication that the drying was too severe. To his mind, all loam jobs should be dried similarly to those methods used for wood, namely, by controlling the humidity of the stove atmosphere, to allow only of a certain definite percentage of moisture being removed for a certain time interval. This principle was, by the way, being used by the General Electric Company in America. "Shelling" was caused, in his opinion, by attempting to dry too fast.

Chaplets.

With reference to chaplets, he wished to know what Mr. Scott used for coating them or what coating was specified. In most foundries making the larger castings a coating of red lead and oil was used, and he had often wondered why this was persisted in being used. It only evolves considerable quantities of oxygen, which will cause blowholes sooner than a perfect weld. Personally, he favoured a coating of guaranteed pure tin or nothing at all, other than pickling them to remove rust and dirt and using immediately.

Recording Moulding Time.

Mr. E. Longden congratulated Mr. Scott on bringing forward a Paper of such an interesting character. The Paper would have been even more useful if sketches of the construction of the mould had been shown; photographs were apt to mask the more important parts of the moulder's work. The tests shown for the metal poured into the turbine cylinder bottom were rather high, although showing a comparatively wide range between 14 and 16 tons.

Would Mr. Scott state whether the times which were given were bonus or piecework hours or day-rate times? He referred to the times taken to produce the engine column after blocking out the underside as moulded. One could agree that the moulding time should include the closing time, recorded separately, would be reduced, but a reduction in coremaking time was surely impossible. The large core introduced by blocking the pattern would increase coremaking by many hours, probably by more than 100 per cent. If this reduction in time were recorded, something was seriously wrong before blocking out the pattern.

Mr. A. Sutcliffe suggested that the core shown in Figs. 21 and 22 could be made on a core barrel turned upon trestles. This would be a cheaper method than the method shown in the Paper, as grids or grates would not be required. One core barrel could be used for an almost unlimited number of castings, whereas new grids would be required for each casting. A saving would also be effected in fettling, as the removal of the grids would occupy more time than would be absorbed in making the core on the barrel. The core barrel could be drawn out by the crane before removing the casting to the fettling shop.

Sand Testing.

Mr. J. G. Pearce wrote that "the author's confirmation of the damaging effects on sand of the old type of runner mill was very interest-

ing. For some time past the Cast Iron Research Association had constantly advised this and urged members to adopt alternative arrangements. The sand tests referred to by the author were embodied in a report of the Association, which was available to all interested persons for a small charge, and the permeability- and compression-testing apparatus could also be purchased from the Association's approved suppliers."

AUTHOR'S REPLY.

In replying to the discussion, MR. SCOTT thanked Mr. Cook for his remarks. He admitted that it took a little courage to give details of the times of the various moulds and cores, but it was done with a definite purpose. He hoped that someone who could show better times on the same class of work would invite him to their foundry to let him see how it was done. On the other hand, should any of these times appear to be extremely short, and anyone who was directly interested, he would be pleased to see them at any time in his foundry to show them how they did it.

He was quite pleased at the suggestion that the Technical Committee might take up this special type of chaplet, as it has been their experience for some years now that this type of chaplet was the only one suitable for the pressure work. Mr. Cook's reason for the reduction in length of the tube was the only one that they could see themselves, and they had to accept this as being the only cause.

Venting and Blow-Holes.

In reply to Mr. Bartlett's question as to which method was used, *i.e.*, the one for cheapest moulding or the best method for good casting, invariably they chose the latter, as in every case methods which produce the best casting are in the long run the cheapest. He was pleased to see Mr. Bartlett's approval of the design of core irons, and that he saw the same bearing in relation to the vents. Regarding the venting of the face of a loam job with a needle wire, he was not quite in agreement with this. This method would certainly prove satisfactory providing the point of the needle penetrated the loam and touched the cinder vent each time, but as one cannot guarantee to do this, where bricks are used, then he did not agree with it. Any vent needle, which was simply pushed in and did not touch the vent itself, would be a serious danger point by forming a small outlet for air and steam right to the metal face, and would be a probable cause of blowholes at that point. In support of this view, he would add that in no case do they use cinders between the brickwork, merely the loam itself.

Mr. Bartlett's remarks on the painting of patterns in definite colours is one with which he was in entire agreement, and he would like to see some uniformity throughout the country on this point. In the works with which he was connected they had a definite system of colouring as follows:—Body of pattern was painted *black*, prints were *red* and all machined faces *brown*. In cases where patterns were put away for possible futher use, he suggested that places where chills were necessary might be painted *white*, as a definite guide when the pattern was once more put into use, probably in one, two or three years' time. This white marking for chills shows up extremely well on the black background of the pattern. He suggested this was another question for the Technical Committee.

Sand Testing.

He thanked Mr. Hudson for his kind compliments, and noticed his suggestion regarding the physical tests in moulding sands. As he had no apparatus available for testing the sand in the dry state, he would be pleased if Mr. Hudson would be kind enough to make these tests for him and he would send on to him some of their sands, the results of which could be published at a later date in the correspondence.

He noted that Mr. Hudson did not agree with him regarding the shelling of heavy-loam cores, but as their experience, over two years with both types of mills, had absolutely proved this point, then he must still disagree with Mr. Hudson. At the present time he was prepared to make two mixings of identical sands, one in the heavy mill and one in the type of mill he had suggested, making two cores of the same shape and size and putting them side by side in the same drying oven. This experiment would prove emphatically that the shelling which would take place on one core was entirely due to the heavy rollers, as all the other conditions were the same. He agreed that all loam jobs should be dried in a similar manner to those used for wood, but where one was concerned with commercial work, where output was a very big consideration, one could not always get quite the same conditions as in a laboratory, and, therefore, the loam which would stand the biggest misuse in the later operations was the one most satisfactory for the job.

They did not use any coating for chaplets, which were used quite clean, and they only purchased those chaplets which were coated with tin. In his opinion, red lead would prevent definite fusion of the metal with the chaplet itself, and was merely a palliative for the covering of rust or other foreign bodies on the chaplet.

Tests on Turbine Cylinders.

He was pleased to have interested Mr. Longden with the details in the Paper. He considered in the first place whether to illustrate the Paper with sketches or photographs, and on the point that photographs cannot lie, he decided to use photographs. Sketches could be made to suit the author's pet theories and fancies without being facts, whereas on one or two of the photographs he found things creeping in which he really did not intend to leave there when the photographs were taken.

He admitted that the tests on the turbine-cylinder bottom would have been better left at 14 tons, as he had taken an average of eight different casts and these only came out at 14½ tons, although in some cases they did actually reach 16 tons. To account for this, he wished to make it clear that these are from test-bars on the job and not cut from the solids. As these are small bars, in the first place a test undoubtedly receives a certain amount of aid from the densening of the metal. The times quoted in the Paper were in every case hours taken on a definite piecework rate, in other words, each job executed by a gang has a definite lump-sum price put on it.

In reply to Mr. Longden's remarks regarding the times of coremaking after blocking out, he expected this question. The only reason he could give for the reduction—and there was a reduction—was a psychological one. The moulders were making moulds quicker, and the coremakers made a genuine attempt to keep pace with them. This seemed rather a thin reason, but it was an undoubted fact that there must be many jobs in many foundries where some such alteration would show what could be done.

Regarding Mr. Sutcliffe's suggestion that cores shown in Figs. 21 and 22 could be made in a core barrel, he quite agreed that this was desirable if the mould had been made in halves longitudinally, and the cores put in position and turned on end for casting. As this was not the case, then he saw no other way to make the cores than the one employed. The job was moulded in sections on end to facilitate coring up the ports, etc., and to facilitate running. Regarding the relative cheapness of the two methods, he saw very little in it, as, in fact, the total saving, if any, may be absorbed in the cost of broken grids. He was pleased to have the valuable opinion of Mr. Pearce on the sand-milling question, and he would be glad to demonstrate this at any time to any visitors to the works.

The Continental Steel Cartel.

The international comptoir for semi-finished steel, which commenced its activities on August 1, has its headquarters in Belgium (presumably Liége), with M. Tonneau, of the Cockerill Company, as the President. The comptoir for shapes, with M. Goldsberger, of the Acieries de Wendel, as President, is domiciled in Paris.

The first meetings of the members of these controlling offices took place at Charleroi on August 1, when discussion ensued concerning the internal organisation of the offices and the reduction in the inland prices. The agreements will run provisionally until the end of this year and will then expire, unless in the meantime arrangements have been concluded respecting the formation of controlling offices for other rolled products. A more favourable opinion is said to rule now concerning the activity of the offices, seeing that a further fall in prices has not taken place and that the Forges de Clabecq are said to have emphasised their adhesion to the Continental Steel Cartel and also agreed to certain matters referring to the export of semi-finished products.

Patent Specifications Accepted.

The following list of Patent Specifications accepted has been taken from the "Illustrated Official Journal (Patents)." Printed copies of the full Specifications are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1s. each. The last numbers given are those under which the Specifications will be printed and abridged, and all subsequent proceedings will be taken.

3,779. HAMILTON, W. B., and EVANS, T. A. Production of metals and alloys by exothermic reduction. 331,892.

10,790. SUTTON, H., SIDERY, A. J., LE BROCQ, L. F., and BRAITHWAITE, C. Preventing corrosion of metallic surfaces. 331,853.

11,248. SOC. MINIERE & METALLURGIQUE DE PENARROYA. Process for the manufacture of purified zinc sulphate solutions. 331,886.

16,209. MCLOUGHLIN, H. F. Electrically-welded metal tubing. 331,998.

23,491. HUMPHRIS, F. Manufacture of pointed fastening devices from sheet metal. 332,076.

34,375. WITT, C. DE. Tubular metal poles for electric power transmission lines. 332,166.

6,720. BRITISH THOMSON-HOUSTON COMPANY, LIMITED. Electric furnaces. 307,031.

10,257. MURPHY, A. F., and JONES, W. Preparing silicon steel sheets for electrical purposes. 331,511.

10,283. RÖTZEL, C. Rolling railway-track rails. 331,514.

12,100. SOC. D'EXPANSION TECHNIQUE. Centrifugal casting of metal pipes. 310,047.

16,320. YOUNGSTOWN SHEET & TUBE COMPANY. Method of and apparatus for welding tubes. 316,964.

16,352. TAYLOR, C. H. Process and machine for producing sand cores for use in casting metals. 331,656.

11,619. SEIL, G. E. Preparation of highly-activated iron oxide. 332,259.

17,176. ZIMMERMANN, G. Foundry moulding machines. 332,347.

25,968. KENWORTHY, C. F. Annealing furnaces. 332,436.

29,198. AMERICAN ROLLING MILL COMPANY. Sheet-metal-rolling processes. 332,462.

33,529. RHODES, C. J. Presses for drawing sheet metal. 332,492.

1,972 MANNESMANNROHREN-WERKE. Process and apparatus for the production of tubes upon a Pilger rolling mill. 332,513.

Japanese Import Tariff on Iron and Steel.—The Japanese Government has decided to make inquiries in regard to a revision of the import duties on iron and steel, considering the conditions after the lifting of the gold embargo and in deference to the petitions of the manufacturers. With this purpose in view the Import Tariff Investigation Committee has given instructions for the drafting of a Bill to be considered by the Committee

The Economic Utilisation of British Pig-Iron Resources.

(*Continued from page* 83.)

District "F"—South and West Yorkshire—*continued.*

Index No.	Firm or Works.	Type.	Designation, Grade or Brand.		COMPOSITION. C. Combd.	C. Gr.	C. Total.	Si.	S.	P.	Mn.	Other Constituents.	Remarks.
41	NEWTON CHAMBERS & CO., LTD., Thorncliffe Ironworks, near SHEFFIELD.	H	SEMI-COLD BLAST—										
		C	Ordinary No. 3	A	0·30	3·00	3·30	2·50	0·03	1·25	1·00	Fe by diff. 88·62	Guaranteed; almost invariably sell to analysis.
		H	„ „	R	0·3	3·00	3·30	2·25—2·75	0·03	1·25—1·35	0·9—1·10	—	
		C	High Silicon No. 3	A	0·20	2·90	3·10	3·75	0·02	1·25	1·00	Fe by diff. 87·78	
		H	„ „	R	0·20	2·90	3·10	3·6—4·0	0·02	1·25—1·75	0·9—1·10	—	
		C	„ No. 4	A	0·40	2·90	3·30	2·0	0·06	1·25	0·90	Fe by diff. 89·19	
				R	0·40	2·90	3·30	1·75—2·25	0·06	1·25	0·90	—	
42	YORKS IRON & COAL CO. LTD., LEEDS.	—	No reply. Not in blast.		Sep. 30.	Missed out of	Dec. 31.						

District "G"—Derbyshire.

43	STANTON IRON WORKS CO., STANTON GATE. (See Notts "I" No. 57.)	—											
44	CLAYCROSS CO., LTD., near CHESTERFIELD.	H	No. 3 Foundry	A	0·36	3·14	(3·50)	3·07	0·02	1·40	0·52	91·49	Figures given are as far as possible actual analyses and really representative.
			„ „	R	—	—	—	3·0—3·5	—	—	—	—	
		H	No. 4 Foundry	A	0·40	2·90	(3·30)	2·7	0·035	1·44	0·52	92·005	
			„ „	R	—	—	—	2·7—2·9	0·035—0·04	—	—	—	
		H	Siliceous Iron	A	0·25	3·46	(3·71)	3·8	0·01	1·44	0·52	90·52	
			„	R	—	—	—	3·8—4·2	—	—	—	—	
45	DENBY IRON & COAL CO., LTD., near DERBY.	—	Our furnaces are not now in blast.										
46	THE BENNERLEY IRON CO., LTD., ILKESTON, DERBYSHIRE.	H	AWSWORTH No. 1	A	0·32	3·75	4·07	3·40	0·01	1·10	0·35	—	—
		H	„ „ 2	A	0·33	3·55	3·88	3·30	0·02	1·10	0·35	—	—
		H	„ „ 3	A	0·35	3·35	3·70	3·20	0·02	1·20	0·40	—	—
		H	„ „ 4	A	0·40	3·00	3·40	2·55	0·03	1·20	0·40	—	—
47	RENISHAW IRON CO., LTD.	H	„ High Silicon ..	A	0·325	2·65	2·975	3·95	0·030	1·30	0·50	—	—
			„ „ ..	R	0·30—0·35	2·5—2·7	—	3·75—4·50	0·025—0·035	1·30—1·50	0·50—0·75	—	—
		H	„ No. 3	A	0·35	2·56	2·91	2·95	0·030	1·30	0·50	—	—
			„ „ 3	R	0·325—0·380	2·50—2·60	—	2·60—3·0	0·025—0·040	1·30—1·50	0·50—0·75	—	—
		H	„ „ 4 Foundry ..	A	0·625	2·275	2·90	2·60	0·04	1·40	0·50	—	—
			„ „ 4 „ ..	R	0·55—0·70	2·275—2·50	—	2·25—2·90	0·035—0·050	1·30—1·50	0·50—0·75	—	—
48	SHEEPBRIDGE COAL & IRON CO., LTD., CHESTERFIELD.	H	„ No. 1 Foundry ..	A	0·08	3·50	3·58	3·50	0·01	1·40	1·00	As,Cr,Cu,Ni traces only	—
		*	„ „ 1 „ ..	R	0·06—0·10	3·45—3·55	3·55—3·65	3·20—3·80	0·006—0·012	1·1—1·5	0·8—1·2		—
		H	„ „ 2 „ ..	A	0·12	3·50	3·62	3·50	0·02	1·40	1·00	„	—
		*	„ „ 2 „ ..	R	0·08—0·15	3·45—3·55	3·55—3·65	3·20—3·80	0·015—0·025	1·1—1·5	0·8—1·2	„	—
		H	„ Silky No. 3 „ ..	A	0·05	3·40	3·45	4·25	0·02	1·40	1·00	„	—
		*	„ „ „ ..	R	0·04—0·08	3·30—3·50	3·35—3·55	4·00—5·00	0·01—0·03	1·1—1·5	0·8—1·2	„	—
		H	„ No. 3 „ ..	A	0·24	3·25	3·49	3·25	0·03	1·40	1·00	„	—
		*	„ „ 3 „ ..	R	0·20—0·30	3·15—3·35	3·45—3·55	3·0—3·5	0·025—0·035	1·1—1·5	0·8—1·2	„	—
		H	„ „ 4 „ ..	A	0·30	3·10	3·40	3·00	0·04	1·40	1·00	„	—
		*	„ „ 4 „ ..	R	0·25—0·35	3·0—3·20	3·35—3·45	2·80—3·20	0·035—0·045	1·1—1·5	0·8—1·2	„	—
		H	„ Close No. 4 „ ..	A	0·50	2·80	3·30	2·50	0·05	1·40	1·00	„	—
		*	„ „ „ ..	R	0·45—0·55	2·7—2·9	3·25—3·35	2·25—2·75	0·06—0·08	1·1—1·5	0·8—1·2	„	—
		†	„ No. 4 Basic ..	A	0·50	2·70	3·20	1·50	0·06	1·50	1·30	„	—
		†	„ „ ..	R	0·45—0·55	2·6—2·8	3·1—3·3	1·4—1·8	0·05—0·07	1·4—1·6	1·2—1·7	„	—
		†	„ Mottled or ..	A	1·50	1·50	3·00	0·90	0·08	1·50	1·10	„	—
		†	„ White Basic ..	R	1·40—1·60	1·40—1·60	2·90—3·10	0·60—1·00	0·07—0·10	1·4—1·6	1·0—1·3	„	—

* 1,200°—1,400° F. † Cool blast, 1,000° F.

District "G"—Derbyshire—*continued.*

†		„	Mottled or ..	A	1·50	1·50	3·00	0·90	0·08	1·50	1·10	„	—	—
†		„	White Basic ..	R	1·40—1·60	1·40—1·60	2·90—3·10	0·60—1·00	0·07—0·10	1·4—1·6	1·0—1·3	„	—	—

* 1,200°—1,400° F. † Cool blast, 1,000° F.

District "G"—Derbyshire – *continued.*

Index No.	Firm or Works.	Type.	Designation, Grade or Brand.		COMPOSITION. C. Combd.	C. Gr.	C. Total.	Si.	S.	P.	Mn.	Other Constituents.	Remarks.
49	STAVELEY COAL & IRON CO., LTD., CHESTERFIELD.	H	STAVELEY No. 1 Foundry ..	A–R	0·15—0·20	3·30	3·45—3·50	2·25—3·50	0·02—0·04	1·45	0·8—1·10	—	—
		H	„ „ 2 „ ..	A–R	0·17—0·25	3·20	3·37—3·45	2·5—3·75	0·02—0·04	1·45	0·8—1·10	—	—
		H	„ „ 3 „ ..	A–R	0·21—0·30	3·20	3·41—3·50	2·5—3·75	0·02—0·055	1·45	0·8—1·10	—	—
		H	„ „ 4 „ ..	A–R	0·25—0·35	3·00	3·25—3·35	2·25—3·75	0·035—0·070	1·45	0·8—1·10	—	—
		H	„ „ 4 Grey Forge	A–R	0·30—0·40	2·90	3·20—3·30	2·00—3·25	0·040—0·080	1·45	0·8—1·10	—	—
		H	„ „ 4 Forge ..	A–R	0·45—0·55	2·80	3·25—3·35	1·8—3·00	0·05—0·09	1·45	0·8—1·10	—	—
		H	„ „ 4 Close Forge	A–R	0·50—0·65	2·60	3·10—3·25	1·5—2·75	0·06—0·10	1·45	0·8—1·10	—	—
		H	„ Mottled	A–R	1·64	1·50	3·14	1·25—1·75	0·10—0·12	1·45	0·5—0·8	—	—
		H	„ White	A–R	3·00	0·10	3·10	1·0—1·5	0·12—0·15	1·45	0·5—0·7	—	—

District "H"—Lincolnshire.

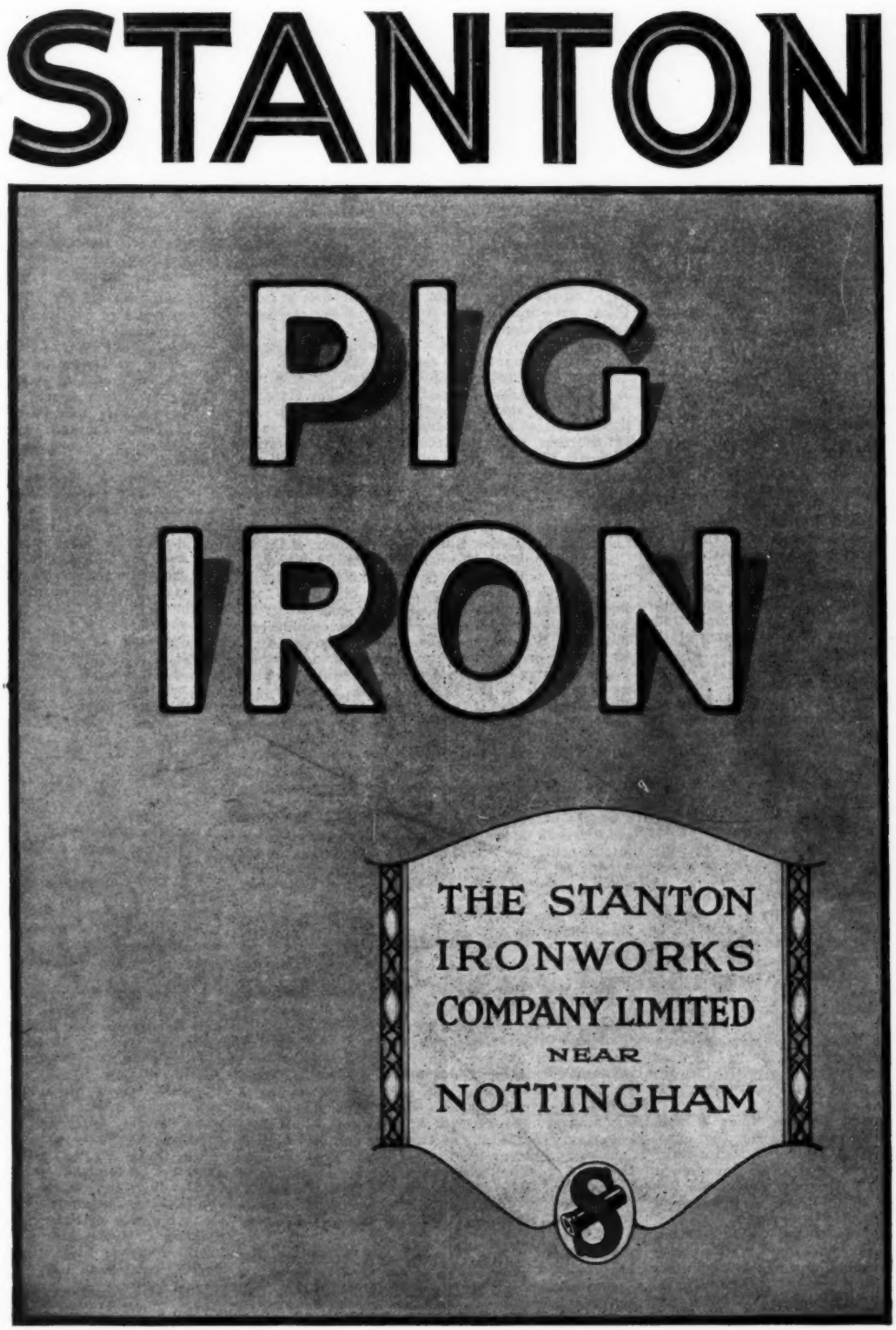
50	THE APPLEBY IRON CO., associated with	H	GREY BASIC (1)	A	2·8	0·6	3·4	1·5	0·06	1·5	1·5	—	Associated Firms.' Brand and analyses supplied for each identical.
		H	„ (2)	A	2·8	0·6	3·4	1·25	0·08	1·5	1·5	—	
51	THE FRODINGHAM IRON & STEEL CO., SCUNTHORPE, LINCS.	H	STANDARD BASIC	A	2·8	0·6	3·4	1·0	0·10	1·5	1·5	—	
52	RICHARD THOMAS & CO., LTD., Redbourn Works, SCUNTHORPE, LINCOLNSHIRE.	H	REDBOURN No. 3 Foundry ..	A	—	—	—	2·60	0·040	1·35	1·45	—	—
		H	„ „ 4 „ ..	A	—	—	—	2·45	0·045	1·30	1·30	—	—
		H	Grey Forge	A	—	—	—	1·75	0·053	1·45	1·60	—	—
		H	No. 4 „	A	—	—	—	1·75	0·063	1·40	1·50	—	—
		H	Close Iron..	A	—	—	—	1·00	0·070	1·20	1·30	—	—
		H	Basic average	A	—	—	—	0·50	0·060	1·40	1·70	—	—
53	NORTH LINCOLNSHIRE IRON CO., SCUNTHORPE.	H	Nos. 3 and 4 FOUNDRY ..	A–R	0·80—0·87	2·58—2·83	3·38—3·70	1·75—3·00	0·06 max.	1·35	2·0—2·50	—	Although wide range shown between min. and max. Si, are able to select iron approx. to specification with 0·5 per cent. tolerance.
		H	CLOSE GRAINED SELECTED	A–R	—	—	3·0—3·30	1·0—2·0	0·08 max.	1·35	1·75—2·25	—	
		H	WHITE	A–R	3·242	0·150	3·392	0·25—0·75	0·10—0·20	1·35	1·00—2·00	—	
54	THE TRENT IRON CO., LTD., SCUNTHORPE LINCOLNSHIRE. Brand throughout "TRENT." (See also British Pig Irons Ltd., No. 65 "K"—N. Staffs.)	H	"TRENT" Good, No. 3 ..	A–R	0·54	2·81	3·35	1·3—2·33	0·03—0·08	1·2—1·4	2·10 max.	—	—
		H	„ Foundry, 4 ..	A–R	0·57	3·11	3·68	1·3—2·05	0·03—0·08	„	1·91	—	—
		H	„ Good Grey, 4 ..	A–R	0·58	2·77	3·35	1·3—1·77	0·03—0·08	„	1·88	—	—
		H	„ Grey, 4	A–R	0·68	2·92	3·60	1·3—1·75	0·04—0·08	„	1·72	—	—
		H	„ Fine Grey, 4 ..	A–R	0·65	2·70	3·35	1·3—1·75	0·04—0·08	„	1·82	—	—
		H	„ No. 4	A–R	0·70	2·55	3·25	1·35	0·04—0·08	„	1·71	—	—
		H	„ Strong, 4	A	0·77	2·37	3·14	1·26	0·08	„	1·53	—	—
		H	„ Mottled, 4 ..	A	0·69	2·76	3·45	1·03	0·061	„	1·63	—	—
		H	„ Mottled	A	0·96	2·23	3·19	0·89	0·078	„	1·74	—	—
		H	„ Spg., 4	A	0·92	2·63	3·55	0·84	0·057	„	1·88	—	—
		H	„ White	A	2·65	0·40	3·05	0·33	0·088	„	1·42	—	—
		H	„ Special Cylinder ..	R	—	—	3·2—3·5	1·0—1·3	0·06—0·08	0·7—1·3	1·2—1·7	—	To suit customers' requirements.
55	JOHN LYSAGHT, LTD., Normanby Park Steel Works, SCUNTHORPE.	H	FOUNDRY No. 1	R	—	—	—	3·0—3·5	0·02—0·03	1·1—1·5	1·3—1·5	—	Claim uniform regularity in composition, and that phosphorus in foundry irons can be regulated to suit requirements within limits stated. Cylinder and basic iron also manufactured.
		H	„ No. 2	R	—	—	—	2·5—3·0	0·02—0·03	1·1—1·5	1·3—1·5	—	
		H	„ No. 3	R	—	—	—	2·25—2·75	0·03—0·05	1·1—1·5	1·3—1·5	—	
		H	„ No. 4	R	—	—	—	1·75—2·25	0·03—0·05	1·1—1·5	1·3—1·5	—	
		H	GREY FORGE	R	—	—	—	1·25—1·75	0·04—0·06	1·1—1·5	1·3—1·5	—	

District "I"—Notts and Leicestershire.

Index No.	Firm or Works.	Type	Designation, Grade or Brand.	COMPOSITION.								Other Constituents.	Remarks.
					C.			Si.	S.	P.	Mn.		
					Combd.	Gr.	Total.						
56	BESTWOOD COAL & IRON CO., near NOTTINGHAM.		Not working September 30 or December 31, 1929.										
57	STANTON IRONWORKS CO., LTD., near NOTTINGHAM (Proprietors of Holwell Iron Co., Ltd., James Oakes & Co., Ironworks Departments, James Pain & Co., Ltd.).	H	"STANTON Siliceous"	A–R	trace	3·5	3·5	4 to 5	0·016	1·35	0·47	—	—
		H	Foundry No. 1	A	0·15	3·5	3·65	3·5	0·015	1·40	0·45	—	—
		H	,, ,, 2	A	0·2	3·49	3·69	3·2	0·020	1·44	0·45	—	—
		H	,, ,, 3	A	0·3	3·35	3·65	2·91	0·025	1·34	0·46	—	—
		H	,, ,, 4	A	0·4	3·15	3·55	2·45	0·05	1·4	0·44	—	—
		H	Cylinder ,, 4	A	0·6	2·91	3·51	2·16	0·064	1·38	0·43	—	—
		H	Forge ,, 4	A	0·8	2·52	3·32	1·95	0·09	1·39	0·39	—	—
		H	Mottled	A	1·5	1·6	3·1	1·25	0·28	1·3	0·33	—	—
		H	White	A	2·9	trace	2·9	0·9	0·35	1·3	0·29	—	—
		H	HOLWELL Siliceous	A	0·06	3·17	3·23	4·0—5·0	0·018	1·36	0·42	—	—
		H	,, Foundry No. 1 ..	A	0·1	3·52	3·62	3·4	0·01	1·4	0·44	—	—
		H	,, ,, ,, 2 ..	A	0·16	3·3	3·46	3·2	0·015	1·39	0·44	—	—
		H	,, ,, ,, 3 ..	A	0·3	3·16	3·46	2·5—3·0	0·02	1·38	0·4	—	—
		H	,, ,, ,, 4 ..	A	0·46	2·83	3·34	2·65	0·047	1·36	0·38	—	—
		H	,, Grey Forge ..	A	0·54	2·66	3·20	2·24	0·06	1·34	0·36	—	—
		H	,, Forge No. 4 ..	A	0·86	2·36	3·22	2·00	0·08	1·32	0·35	—	—
		H	,, Mottled	A	1·6	1·3	2·9	1·31	0·22	1·31	0·26	—	—
		H	,, White	A	2·54	0·4	2·94	0·93	0·27	1·3	0·24	—	—

District "J"—Northamptonshire.

58	NEW CRANSLEY IRON & STEEL CO., KETTERING.	H	CRANSLEY No. 2	A	0·1	3·3	3·4	3·3	trace	1·60	0·35	—	—
			,, ,, ...	R	—	—	—	3·0—3·5	—	—	—	—	—
		H	,, No. 3	A	0·2	3·3	3·5	3·0	trace	1·60	0·35	—	—
			,, ,, ...	R	—	—	—	(2·75—3·25)	—	—	—	—	—
		H	,, No. 4	A	0·4	2·6	3·0	2·5	0·03	1·60	0·35	—	—
			,, ,, ...	R	—	2·5—2·75	—	2·25—2·75	—	—	—	—	—
		H	,, No. 3 Siliceous ..	A	trace	3·5	3·5	4·5	trace	1·60	0·35	—	—
			,, ,, ..	R	—	—	—	4·5—5·0	—	—	—	—	—
		H	,, Grey Forge ..	A	1·0	2·0	3·0	2·25	0·04	1·60	0·35	—	—
			,, ,, ..	R	—	—	—	2·0—2·50	—	—	—	—	—
59	ISLIP IRON CO., LTD., Thrapston, KETTERING (postal).	H	ISLIP Foundry	A	0·05	3·20	(3·25)	3·00	0·025	1·60	0·30	—	—
			,, ,, ...	R	—	—	—	2·0—4·50	0·01—0·040	1·60	0·30	—	—
		H	,, Forge	A	0·25	3·00	(3·25)	2·50	0·070	1·60	0·30	—	—
		H	,, ,, ...	R	—	—	—	1·70—3·00	0·04—0·10	1·60	0·30	—	—
60	The KETTERING IRON & COAL CO., LTD.	H	"KETTERING" No. 1 Fdy...	A	0·02	3·13	3·15	3·10	0·012	1·60	0·38	91·758	"Usually sold by fracture in this district."
		H	,, No. 3 ,, ..	A	0·085	3·125	3·21	2·85	0·025	1·60	0·35	91·965	"Undertake limits of ½ per cent. in Silicon content—2·5—3, 2·75—3·25, 3—3·5."
		H	,, Forge ..	R	—	—	—	1·0—1·9	—	—	—	—	
		H	,, 4—5% Siliceous ..	A	traces	2·80	2·80	4·5	0·009	1·62	0·36	90·711	"Make 4—4·25, 4—4·5, 4·5—5 per cent. Siliceous."
		H	,, No. 3 High Silicon Fdy.	A	—	—	—	3·75	Under 0·02	—	—	—	—
		H	,, No. 4 Fdy.	A	—	—	—	2·75	—	—	—	—	Silicon varied to suit requirements.
		H	,, Higher Silicon Irons ..	A	—	—	—	5—6%	—	—	—	—	—


STANTON
PIG
IRON
THE STANTON
IRONWORKS
COMPANY LIMITED
NEAR
NOTTINGHAM

Trade Talk.

The Workmen's Compensation (Silicosis and Asbestosis) Act, 1930, has received the Royal Assent.

The production of steel castings in France during the month of June amounted to 22,000 tons. The total for Belgium was 7,960 tons.

Seven ships, totalling more than 30,000 gross tons, were launched on the Wear during July. Last year's total for the corresponding month was 27,604 tons.

The German output of steel castings during June included 11,607 tons of basic steel, 5,016 tons of acid steel and 1,775 tons of crucible and electric steel.

Two substantial orders for forgings for Canada have been received by the English Steel Corporation, Limited, and are being executed at the River Don Works, Sheffield.

Messrs. E. F. Houghton & Company, 3rd American and Somerset Streets, Philadelphia, U.S.A., manufacturers of oils and leather goods, are planning to erect a factory either in Manchester or Liverpool.

At meetings of Associated Electrical Industries, Limited, held recently, resolutions for the adoption of a new set of articles and for the subdivision of the £2 preference shares into two shares of £1 each were passed.

The Clyde Navigation Trustees have placed an order for the supply of six 5-ton electric cranes for Kingston Dock and Custom House Quay with Messrs George Russell & Company, Limited, Alpha Engineering Works, Motherwell.

It is gratifying to learn that despite the condition of trade in the heavy industries, Messrs. General Refractories, Limited, of Sheffield, report an increase in sales turnover for the first half of this year as compared with 1929.

Arrangements have been completed for the construction of a bridge across the Nile at Cairo. A message from Egypt states that the tender submitted by Messrs. Dorman, Long & Company, Limited, to carry out the work for £308,000 has been accepted.

There will be no change in the wages of the workmen in the Scottish manufactured iron trade following upon the accountants' examination of the employers' books for May and June. The average net selling price brought out being £10 10s. 9.665d.

Messrs. Perrin, Hughes & Company, Limited, brassfounders, Hatton Garden, Liverpool, have extended their premises at 167, Foregate, Chester, by acquiring the adjoining premises, which have been fitted as showrooms. The frontage is of modern style with window frames in silveroid.

The patternmaking staff of the Camelon Iron Company, Limited, Falkirk, held their annual outing on Saturday last to Largs. Mr. John Henry, who has just retired from the management of the department after 50 years' service with the company, extended a hearty welcome to a few specially-invited guests.

After an extended holiday, the steel-rolling mill resumed at Messrs. David Colville's Clydebridge Steelworks, Cambuslang, near Glasgow, on August 5. After an hour or two's working, a breakdown occurred, which caused the suspension of operations. It is expected that the repairs will be effected in about a week.

Messrs. Cammell Laird & Company, Limited, Birkenhead, launched recently the "Recorder," the second of two large cargo vessels they are building for the Charente Steamship Company, Limited, Liverpool. The vessel is 418 ft. long, with a breadth of 54 ft. and a depth of 33 ft. The boilers are to be fired with pulverised coal.

The tender of Messrs. Dorman, Long & Company, Limited, of Middlesbrough, for the reconstruction of the Kasr-el-Nil Bridge, in Cairo, which has been accepted by the Egyptian Government, amounts to £E.308,250. Approximately 3,000 tons of steel will be used, all of which is to be manufactured and rolled at Middlesbrough.

The introduction of additional mechanism into a Motherwell steelworks has had double consequences in the displacement of a number of workmen and the application of the men retained in that section for an increase of wages. The union concerned in the negotiations, in supporting the claim, states that, with the new machinery which has been introduced, the steam-service men have additional duties to perform, and on that ground claim an increase of wages. Negotiations are presently proceeding between the union and the employers.

Speaking at the annual divisional meeting of the British Iron and Steel Trades Confederation at Swansea, Mr. Morgan Rees, divisional secretary, urged the greater use of steel for roof supports and railway sleepers, in place of timber, pointing out that the home market would benefit, and to an equal extent employment of British labour would increase. British iron and steel designs, he said, deserved greater consideration on the part of local authorities in building construction and bridge building. It was computed in America that there was offered an outlet for 5,000,000 tons of steel per annum for residences built in the United States. This indicated the potentialities of the use of steel.

The launch of the twin-screw motorship "Polyphemus" from the Cartsburn Dockyard marks a stage in the long-established connection between Messrs. Scott's Shipbuilding Company and Messrs. Alfred Holt & Company, Limited. The "Polyphemus" is the eightieth ship built for the same owners by Messrs. Scott, and has been designed for special service on the Java route. The propelling machinery is of interest, inasmuch as it represents a departure from any specialised type, and consists of two sets of six-cylinder, four-stroke, single-acting engines to work with turbo-superchargers built by Messrs. Scott in association with the North Eastern Marine Engineering Company, Limited.

Messrs. Cox & Danks, Limited, who are engaged on the salvage of the ex-German fleet at Scapa Flow, were successful recently in raising the battle cruiser "Hindenburg." The "Hindenburg" is the largest warship that has ever been raised, her displacement being 28,000 tons, length 750 ft., and beam 96 ft. She will be broken up. Messrs. Cox & Danks, Limited, have now been successful in raising three battle cruisers, one battleship, one light cruiser and 25 destroyers, totalling in all 127,500 tons, since they commenced their operations at Scapa Flow in 1924, and their attention will now be directed on either the 25,000-ton battleship "Prinz Regent Luitpold" or the 20,000-ton battle cruiser "Von der Tann."

According to information received at the British Columbia Legislative Building at Victoria, B.C., the Coast Range Steel Company, Limited, recently incorporated with a capital of $23,000,000 for the manufacture of steel from Texada Island ores, will shortly make application to the Government for the bounty provided for by legislation. Under the Provincial Statute, the Government may pay up to $3 a ton on pig-iron manufactured in British Columbia from ores mined in the Province, or $1.50 for iron made in the Province from imported ores. The Government is authorised to spend up to $2,000,000 on such bounties. The actual payments may be varied as the Government sees fit, and could be paid in smaller instalments over a longer period. If the whole of the pig-iron output of the Coast Range Steel Company were manufactured from Texada Island ores, they would be entitled to claim a bounty of $3 per ton. The Provincial authorities are stated to be keenly interested in the negotiations for financing the venture, and to be anxious to contribute to the success of the concern. The plant would be erected in the neighbourhood of Vancouver.

New Companies.

Associated Founders & Engineering Company, Limited, 16, Upper St. Martin's Lane, London, W.C.—Capital £2,000. Directors: M. A. H. Macintosh (managing), G. Hollands and T. H. Wright.

Lancashire Steel Corporation, Limited.—Capital £5,750,000, to acquire and carry on under unified control the steel, iron and allied manufactures and businesses of the Pearson & Knowles Coal & Iron Company, Limited, the Partington Steel & Iron Company, Limited, and the Wigan Coal & Iron Company, Limited. Directors: A. L. Arnold, Lord Balniel, the Earl of Crawford and Balcarres, J. T. de Seyfried, J. Ferguson, J. Hawson, A. M. Lamb, Sir Wm. P. Rylands, J. S. Kerr, J. F. Taylor and A. Whyte.

Bituminous Pipe Linings, Limited.—Capital £15,000, to acquire letters patent and the benefit of inventions relating to improvements in lining iron and steel pipes, and to adopt an agreement with B. Talbot, the South Durham Steel & Iron Company, Limited, Cochrane & Company, Limited, Stewarts & Lloyds, Limited, Guest, Keen & Piggotts, Limited, Thomas Piggott & Company, Limited, Arthur Dyson, the British Mannesmann Tube Company, Limited, and Clayton, Son & Company, Limited. Directors: B. Talbot, A. N. McQuistan, W. Stewart, T. E. Upjohn, A. Dyson, L. Hall and R. G. Thomson.

Personal.

Mr. J. C. Williams, President of the Weirton Steel Company, Weirton, West Virginia, America, is spending a short vacation in Europe.

Mr. Gavin S. Hamilton, of the Motherwell Steelworks, is leaving shortly to take up an important appointment with the United Steel Company, Limited, at their Workington branch.

Mr. Frank Hodson, a well-known Sheffield metallurgist, who has been resident in Philadelphia, Pa., for the last 10 years, is at present in England. He is staying at the Hotel Russell, London, W.C.

Mr. F. A. Melmoth, late of Thomas Firth & Sons, Sheffield, and Lake & Elliott, Braintree, has been promoted from that of technical director to assistant manager of the Detroit Steel Casting Company, Detroit, U.S.A.

Mr. J. Brown, of the A. O. Smith Corporation of Milwaukee, is staying at the Savoy Hotel, London. His firm, which manufactures electric-welded pipe and high-pressure vessels, has just bought a six-seater monoplane for the transport of its engineers.

Wills.

Dieselhorst, H. W., formerly general manager of Messrs. Siemens Bros. & Company, Limited	£8,944
Smiley, J., of Waterloo Place, Londonderry, proprietor of Messrs. T. & J. Smiley, iron and steel merchants ...	£8,198
Caillard, Sir Vincent, of Trowbridge, prominently associated with Messrs. Vickers, Limited, and other companies	£92,261
Johnson, E., head of Messrs. Richard Johnson & Nephew, Limited, of Bradford Ironworks, Manchester, wire drawers and rollers	£433,604
Bedford, H. H., chairman of Messrs. John Bedford & Sons, Limited, Sheffield, steel and file manufacturers and merchants, a former Master Cutler ...	£41,299
Sinclair, D., chairman of British Insulated Cables, Limited, and a director of the St. Helens Cable & Rubber Company, Limited	£82,254
Lang, P. M., a director of Messrs. P. MacCallum & Sons, Limited, iron merchants and shipowners, of Greenock, and of Messrs. John G. Kincaid & Company, Limited, marine engineers	£236,446

Obituary.

Mr. Richard Owen, a director of the Dynevor Engineering Company, Limited, Neath, died recently in his 88th year.

The death is announced of Mr. John Thos. Jackson (61), director of Messrs. Jackson & Ogden, Limited, engineers, Lansdowne Ironworks, Oldham.

Mr. Percy Hutchinson, the Indian representative of Messrs. Dorman, Long & Company, Limited, Middlesbrough, died recently in a London nursing home.

Mr. Gilbert Keighley, of Keighley & Company, Bankhouse Iron Works, Burnley, has died suddenly in a London nursing home. He was taken ill after a visit to Germany to see the "Passion Play."

The death has occurred, at his home in Shotts, of Mr. William Hamilton, at the age of 92. Mr. Hamilton served his apprenticeship as a moulder, and retired a few years ago after more than 50 years' service with the Shotts Iron Company, Limited.

Mr. John Gray Crookston died at Schuls-Tarrasp, Switzerland, on August 2, at the age of 65. Born at Glasgow, he was educated at Odessa and Glasgow, becoming an engineer and naval architect. He was vice-president of the Russian Shipbuilding Company and of the naval yard of Nicolaieff, and managing director of the Salamander steelworks at Riga.

A Mixing for Match Boards.—One part of litharge is mixed with 24 parts of new moulding sand which has previously been put through a fine sieve. To this approximately 4 to 5 parts of raw linseed oil is added in small quantities. It is then rammed up in the usual manner and allowed to stand for 18 to 24 hrs., according to the size made. The mixture is economical and gives excellent results as compared with plaster boards.

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Iron and Steel Markets.

Pig-Iron.

MIDDLESBROUGH.—As has been previously outlined in these reports, conditions in the Cleveland iron market continue practically stationary in a dull monotony of inactivity, with, it is to be feared, but faint prospects of an early return of anything approaching permanent improvement in business. It may be argued, of course, that midsummer is invariably a quiet time in most of the heavy industries, due to climatic influences and the customary holiday-making at this period, but on this occasion that explanation is quite insufficient to account for the widespread lethargy now persisting throughout the Cleveland area, in which outputs of pig-iron have already shrunk to almost unprecedented proportions. Buying in the local markets is now curtailed to almost retail limits, second-hands holding little Cleveland pig, and their opportunities of dealing in that commodity being very restricted. Under their terms of contracts with ironmasters, merchants cannot sell to the principal home consumers, who have to come on the market for their supplies, and export demand is quite trifling. Odd sales of Midland pig and Continental iron by merchants here, both for local and other use, are, however, reported. In the meantime stocks of iron stored at the blast furnaces are gradually growing, but are not likely to be allowed to reach inconvenient dimensions. Makers will resort to more damping down rather than accumulate heavy stocks. Fixed minimum figures for Cleveland pig remain:—No. 1 grade, 70s.; No. 3 G.M.B., 67s. 6d.; No. 4 foundry, 66s. 6d.; and No. 4 forge, 66s.

Makers of East Coast hematite, though embarrassed by heavy stocks, amounting, it is estimated, to 100,000 tons, are making strenuous efforts to maintain prices at firm levels, so far, with a fair amount of success. Second-hands still hold rather considerable quantities they are anxious to dispose of, and are shading makers' quotations, the latter remaining at 71s. for ordinary quality mixed numbers, with the usual 6d. per ton extra for No. 1. On the North-West Coast, Bessemer mixed numbers are quoted at 70s. per ton at works.

LANCASHIRE.—The recent action of the Midland pig-iron producers in reducing quotations 2s. 6d. per ton has had, so far, little actual effect in stimulating market activity, but it is, perhaps, too early to form an accurate estimate of its ultimate benefit from the consumers' point of view. At all events, for the present, buying is on very limited lines, with prices as previously recorded, quotations ruling for No. 3 Derbyshire and Staffordshire at 72s., with Scotch brands from 93s. to 94s., all delivered local stations.

THE MIDLANDS.—In this district the prevailing holiday-making has temporarily interrupted market operations in foundry pig, and, with many consumers' works suspended for the time being, little business can be reported. Prices remain firm at the recently reduced levels, as follow:—No. 3 Northants, 70s.; No. 3 Derbyshire, 73s. 6d.; No. 3 North Staffordshire, 73s. 6d.; with Scotch iron on offer at 93s. 6d. to 97s. 6d.; all per ton delivered local stations.

SCOTLAND.—A general re-start has now been made by the steelworks and founders in Scotland following the annual Fair holidays. Unfortunately, the stoppage has not brought about any accumulation of new business worthy of note, and trade accordingly remains very dull, with no indications of any change for the better. Prices are unchanged for foundry iron, No. 3 Scotch foundry being quoted at the official minimum of 76s. 6d. f.o.t. furnaces.

Finished Iron.

Most of the works in the Birmingham area producing this class of material having been idle, owing to an extension of the usual holiday period, will be restarted this week, although business continues very poor, especially in connection with crown and nut and bolt iron. The former is offered by works in this and other areas at about £10 per ton to £10 5s., with nut and bolt iron at £9 to £9 5s. There is very little business possible for bolt iron for the English works, as the bulk of the trade is placed on the Continent, where the price is much lower. The makers of Staffordshire marked bars continue to be fairly well occupied, and their price for this grade is unchanged at £12 10s. delivered works.

Steel.

The Continental position as regards semi-finished steel appears to have been stabilised at the lower level of values recently fixed. In spite of the supposedly minimum prices business was already being done prior to the reduction at equivalent values to those now officially recognised. The prices of British semis are being maintained, although concessions off the quoted prices are available when any large tonnage is in question. At the moment, however, very little business is being placed with either the home or foreign works. The tinplate market continues slow, but the price remains steady at 18s. for coke-finish quality, net cash, f.o.b. Welsh ports.

Scrap.

Demand for this form of foundry material continues very quiet, and on Tees-side this week prices were a shade easier, heavy ordinary cast iron being quoted 55s.; heavy machinery metal, 57s. 6d.; and heavy steel scrap, 47s. 6d. In Scotland the market for cast-iron scrap is again restricted to purchases for current needs. Heavy machinery is quoted nominally at 63s. to 65s. per ton, with little business moving, and heavy ordinary cast-iron scrap suitable for foundries is offered at 57s. 6d. per ton. Steelworks cast iron in furnace sizes is 52s. 6d. to 55s. per ton, and railway chairs 58s. 6d. per ton. Odd wagons of light metal are changing hands at 74s. 6d. per ton, and furnace bars are at 45s. per ton, delivered f.o.t. consumers' works.

Metals.

Copper.—The tendency of markets for base metals during the past week has been generally inclined to dealings limited in volume, but fairly steady on the whole. Apparently, any idea of a rise in the American price from 11 cents per lb. has been abandoned, in view of the huge stocks and the poor prospect of any substantial reduction for some considerable time. While advices from America put the sales for domestic use and export during July at the high figure of 160,000 tons, the estimate is not considered reliable.

Closing quotations:—

Cash.—Thursday, £48 3s. 9d. to £48 5s.; Friday, £48 6s. 3d. to £48 7s. 6d.; Monday, £48 to £48 2s. 6d.; Tuesday, £47 16s. 3d. to £47 17s. 6d.; Wednesday, £47 10s. to £47 11s. 3d.

Three Months.—Thursday, £48 3s. 9d. to £48 5s.; Friday, £48 6s. 3d. to £48 7s. 6d.; Monday, £47 18s. 9d. to £48; Tuesday, £47 18s. 9d. to £48; Wednesday, £47 11s. 3d. to £47 12s. 6d.

Tin.—On the announcement of the July statistics disclosing a small decrease in the visible supply of the metal, the price of tin at last week's close hardened to £136 10s. General anticipation foreshadowed a substantial increase in stocks, but American deliveries at 6,130 tons were better than expected, while total deliveries showed an increase of 944 tons over the June figures. Within the next few months there should be quite a notable shrinkage in the world's visible supply, which would prove an important factor in the eventual recovery of the market.

Official closing prices:—

Cash.—Thursday, £136 10s. to £136 12s. 6d.; Friday, £136 7s. 6d. to £136 10s.; Monday, £136 5s. to £136 7s. 6d.; Tuesday, £135 15s. to £135 17s. 6d.; Wednesday, £134 12s. 6d. to £134 15s.

Three Months.—Thursday, £138 7s. 6d. to £138 10s.; Friday, £138 5s. to £138 7s. 6d.; Monday, £138 to £138 2s. 6d.; Tuesday, £137 10s. to £137 12s. 6d.; Wednesday, £136 10s. to £136 12s. 6d.

Spelter.—There has been a certain amount of reaction from the recent advance in spelter prices. A disappointing trade demand, together with doubts about the negotiations for the re-forming of the cartel, led to weakness and a downward price movement. There has been no improvement in the galvanised-sheet trade.

Daily fluctuations:—

Ordinary.—Thursday, £16 2s. 6d.; Friday, £16 1s. 3d.; Monday, £16 2s. 6d.; Tuesday, £16; Wednesday, £15 17s. 6d.

Lead.—There has been no change in the condition of the lead market. The demand remained quiet, with little interest shown in forward buying.

The week's prices have been:—

Soft Foreign (Prompt).—Thursday, £18 7s. 6d.; Friday, £18 7s. 6d.; Monday, £18 5s.; Tuesday, £18 13s. 9d.; Wednesday, £18 1s. 3d.

White Metal Patterns.—These may be successfully made from a mixture of:—Lead, 40; tin, 40; copper, 1; antimony, 17; and bismuth, 2 per cent. Although this composition may be rather more expensive than others, it is eminently suitable where patterns have to be duplicated, as there is little or no contraction. A hard and durable metal is produced, these physical properties resulting from the introduction of antimony and bismuth.

Iron-Manganese-Silicate Slags and Deoxidation Practice.—Experimental work on the physical characteristics of slags, composed of iron oxide, manganese oxide and silica, conducted at the Pittsburgh Experiment Station of the U.S. Bureau of Mines, in co-operation with the Carnegie Institute of Technology and the Metallurgical Advisory Board, has shown that the range of very fluid slags is considerably smaller than has been heretofore suspected. Fairly fluid slags are encountered over a large portion of the ternary diagram FeO-MnO-SiO_2, the boundaries of this portion being about 10 per cent. and 50 per cent. SiO_2. On the slags low in FeO, the most fluid slags were found in the range 20 to 35 per cent. silica, 50 to 75 per cent. MnO, and 0 to 40 per cent. FeO. In normal deoxidation practice the slags (inclusions) formed are usually in the fairly fluid or viscous ranges, and to obtain slags in the very fluid range will require close control over deoxidation practice. Investigations on this phase of deoxidation are now in progress.

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WEEKLY PRICE CURRENT.

COPPER.

	£	s.	d.
Standard cash	47	10	0
Three months	47	11	3
Electrolytic	51	0	0
Tough	49	10	0
Best selected	50	0	0
Sheets	79	0	0
India	63	0	0
Wire bars	52	2	6
Do. September	52	2	6
Do. October	52	2	6
Ingot bars	52	2	6
H.C. wire rods	54	0	0
Off. av. cash, July	48	6	10½
Do., 3 mths., July	48	0	7 15/23
Do., Sttlmnt., July	48	7	6
Do., Electro, July	53	7	6
Do., B.S., July	53	1	4½
Do., wire bars, July	54	4	6 1/23
Solid drawn tubes			11½d.
Brazed tubes			11½d.
Wire			8½d.

BRASS.

Solid drawn tubes	10½d.
Brazed tubes	12½d.
Rods, drawn	10½d.
Rods, extd. or rlld.	6½d.
Sheets to 10 w.g.	8½d.
Wire	8½d.
Rolled metal	8½d.
Yellow metal rods	6½d.
Do. 4 × 4 Squares	7d.
Do. 4 × 3 Sheets	7½d.

TIN.

	£	s.	d.
Standard cash	134	12	6
Three months	136	10	0
English	136	0	0
Bars	138	0	0
Straits	136	0	0
Australian	135	15	0
Eastern	138	5	0
Banca	139	5	0
Off. av. cash, July	134	11	10 4/23
Do., 3 mths., July	136	6	5 15/23
Do., Sttlmt., July	134	12	4 19/23

SPELTER.

	£	s.	d.
Ordinary	15	17	6
Remelted	14	12	6
Hard	12	5	0
Electro 99.9	18	5	0
English	16	7	6
India	14	2	6
Zinc dust	22	0	0
Zinc ashes	4	0	0
Off. aver., July	16	9	5 7/23
Aver., spot, July	16	3	5 3/23

LEAD.

	£	s.	d.
Soft foreign ppt.	18	1	3
English	19	10	0
Off. average, July	18	2	2 17/23
Average spot, July	18	3	2 13/23

ZINC SHEETS, &c.

	£	s.	d.
Zinc sheets, English	26	0	0
Do. V.M. ex-whf.	25	10	0
Rods	30	0	0
Boiler plates	22	0	0
Battery plates	23	0	0

ANTIMONY.

	£	s.	d.
Special brands, Eng.	38	0	0
Chinese	27	0	0
Crude	21	0	0

QUICKSILVER.

	£	s.	d.
Quicksilver	22	10	0

FERRO-ALLOYS AND STEEL-MAKING METALS.

Ferro-silicon—	
25%	£7 17 6
45/50%	£11 10 0
75%	£18 10 0
Ferro-vanadium—	
35/56%	12/8 lb. Va.
Ferro-molybdenum—	
70/75% c. free	4/2 lb. Mo.
Ferro-titanium—	
23/25% carbon-free	11½d. lb.
Ferro-phosphorus, 20/25%	£16 0 0
Ferro-tungsten—	
80/85%	2/3 lb.
Tungsten metal powder—	
98/99%	2/6 lb.
Ferro-chrome—	
2/4% car.	£30 10 0
4/6% car.	£23 10 0
6/8% car.	£22 7 6
8/10% car.	£22 0 0
Ferro-chrome—	
Max. 2% car.	£33 10 0
Max. 1% car.	£36 17 6
Max. 0.70% car.	£37 17 6
70% carbon-free	11d. lb.
Nickel—99% cubes, or pellets	£175 0 0
Ferro-cobalt	9/7 lb.
Aluminium 98/99%	£95 0 0
Metallic chromium—	
96/98%	2/7 lb.
Ferro-manganese (net)—	
76/80% loose	£11 0 0 to £11 15 0
76/80% packed	£12 0 0 to £12 15 0
76/80% export	£11 0 0 to £11 15 0
Metallic manganese—	
94/96% carbonless	1/4 lb.

Per ton unless otherwise stated.

HIGH-SPEED TOOL STEEL.

Finished bars, 14% tungsten	£0 2 2
Finished bars, 18% tungsten	£0 3 0

Per lb. net, d/d buyers' works.

Extras—	
Rounds and squares, 3 in. and over	4d. lb.
Rounds and squares, under ½ in. to ¼ in.	3d. lb.
Do., under ¼ in. to 7/16 in.	1/- lb.
Flats, ½ in. × ¼ in. to under 1 in. × ½ in.	3d. lb.
Do., under ½ in. × ¼ in.	1/- lb.
Bevels of approved sizes and sections	6d. lb.

Bars cut to length, 10% extra.

SCRAP.

	£	s.	d.	£	s.	d.
South Wales—						
Heavy steel				2	15	0
Bundled steel and shrngs.	2	10	0 to	2	13	0
Mixed iron and steel	2	7	6 to	2	10	0
Heavy cast iron	2	14	0 to	2	15	0
Good machinery for foundries	2	15	0 to	2	17	6
Cleveland—						
Heavy steel				2	7	6
Steel turnings				2	0	0
Cast-iron borings				1	15	0
Heavy forge				3	7	6
W.I. piling scrap				3	3	0
Cast-iron scrap	2	15	0 to	2	17	6
Midlands—						
Ord. cast-iron scrap				2	12	6
Heavy wrought				3	5	0
Steel turnings				1	7	0
Scotland—						
Heavy steel				2	10	0
Ordinary cast iron				2	17	6
Engineers' turnings				1	16	0
Cast-iron borings				1	11	0
Wrought-iron piling				3	5	0
Heavy machinery				3	3	0

London—Merchants' buying prices delivered yard.

	£	s.	d.
Copper (clean)	44	0	0
Brass	32	0	0
Lead (less usual draft)	16	5	0
Tea lead	12	15	0
Zinc	9	10	0
New aluminium cuttings	56	0	0
Braziery copper	41	0	0
Gunmetal	43	0	0
Hollow pewter	100	0	0
Shaped black pewter	75	0	0

PIG-IRON.

(f.o.t. unless otherwise stated.)

N.E. Coast—	
Foundry No. 1	70/-
Foundry No. 3	67/6
Foundry No. 4	66/6
Forge No. 4	66/-
Hematite No. 1	71/6
Hematite M/Nos.	71/-
N.W. Coast—	
Hem. M/Nos. d/d Glas.	83/-
„ d/d Birm.	88/6
Midlands—	
Staffs. common*	—
„ No. 4 forge*	68/6
„ No. 3 fdry.*	73/6
Shrops. basic	—
„ Cold blast, ord.	—
„ „ roll iron	—
Northants forge*	65/-
„ fdry. No. 3*	70/-
Derbyshire forge*	68/6
„ fdry. No. 3*	73/6
„ basic*	—
*d/d Black Country dist.	
Scotland—	
Foundry No. 1	79/-
„ No. 3	76/6
Hem. M/Nos.	78/6
Sheffield (d/d district)—	
Derby forge	63/6
„ fdry. No. 3	68/6
Lincs. forge	—
„ fdry. No. 3	70/-
E.C. hematite	83/6
W.C. hematite	86/6
Lincs. (at furnaces)—	
Forge No. 4	—
Foundry No. 3	—
Basic	—
Lancashire (d/d eq. Man.)—	
Derby forge	67/-
„ fdry. No. 3	72/-
Staffs foundry No. 3	72/-
Dalzell, No. 3 (special)	105/- to 107/6
Summerlee, No. 3	93/- to 94/-
Glengarnock, No. 3	—
Eglinton, No. 3	93/- to 94/-
Gartsherrie, No. 3	93/- to 94/-
Monkland, No. 3	93/- to 94/-
Shotts, No. 3	93/- to 94/-

FINISHED IRON AND STEEL.

Usual District deliveries for iron; delivered consumers' station for steel.

	£	s.	d.	£	s.	d.
Iron—						
Bars (or.)				10	15	0
Nut and bolt iron	9	0	0 to	9	5	0
Hoops				10	15	0
Marked bars (Staffs) f.o.t.				12	10	0
Gas strip				10	15	0
Bolts and nuts, ¼ in. × 4 in.				15	5	0
Steel—						
Ship plates	8	15	0 to	8	17	6
Boiler plts.	9	15	0 to	10	10	0
Chequer plts.				10	12	6
Angles				8	7	6
Tees				9	7	6
Joists				8	10	0
Rounds and squares, 3 in. to 5½ in.				9	7	6
Rounds under 3 in. to ¾ in. (Untested)				7	15	0

and upwards

	£	s.	d.
Flats—8 in. wide and over	8	12	6
„ under 8 in. and over 5 in.	8	17	6
Rails, heavy	8	10	0
Fishplates	12	0	0
Hoops (Staffs)	9	5	0 to 9 15 0
Black sheets, 24 g.	9	12	6 to 9 15 0
Galv.cor.shts., 24g.	11	17	6
Galv. fencing wire, 8g. plain	12	0	0
Billets, soft	5	17	6 to 6 5 0
Billets, hard	7	10	0 to 8 0 0
Sheet bars	5	12	6 to 6 0 0
Tin bars			6 0 0

PHOSPHOR BRONZE.

	Per lb. basis.
Strip	1/0½
Sheet to 10 w.g.	1/1½
Wire	1/1½
Rods	1/1
Tubes	1/5½
Castings	1/1½

Delivery 3 cwt. free.
10% phos. cop. £30 above B.S.
15% phos. cop. £35 above B.S.
Phosphor tin (5%) £30 above price of English ingots.
C. Clifford & Son, Limited.

NICKEL SILVER, &c.

	per lb.
Ingots for raising	8d. to 1/2
Rolled—	
To 9 in. wide	1/2 to 1/8
To 12 in. wide	1/2½ to 1/8½
To 15 in. wide	1/2½ to 1/8½
To 18 in. wide	1/3 to 1/9
To 21 in. wide	1/3½ to 1/9½
To 25 in. wide	1/4 to 1/10
Ingots for spoons and forks	8d. to 1/4½
Ingots rolled to spoon size	11d. to 1/7½
Wire round—	
3/0 to 10 G.	1/5½ to 2/0½

with extras according to gauge.

AMERICAN IRON AND STEEL.

At Pittsburgh unless otherwise stated.

	Dols.
No. 2 foundry, Phila.	19.76
No. 2 foundry, Valley	18.00
No. 2 foundry, Birm.	14.00
Basic	19.76
Bessemer	20.26
Malleable	20.26
Grey forge	19.26
Ferro-mang. 80%	94.00
O.-h. rails, h'y, at mill	43.00
Billets	31.00
Sheet bars	31.00
Wire rods	36.00
	Cents.
Iron bars, Phila.	2.09
Steel bars	1.65
Tank plates	1.65
Beams, etc.	1.65
Skelp, grooved steel	1.70
Skelp, sheared steel	1.70
Steel hoops	1.95
Sheets, black, No. 24	2.45
Sheets, galv., No. 24	3.10
Sheets, blue an'l'd, No. 13	2.15
Wire nails	2.05
Plain wire	2.30
Barbed wire, galv.	2.80
Tinplates, 100-lb. box	$5.25

COKE (at ovens).

Welsh foundry	25/- to 27/6
„ furnace	17/- to 21/-
Durham and Northumberland—	
„ foundry	14/6 to 15/6
„ furnace	14/- to 14/6
Midlands, foundry	—
„ furnace	—

TINPLATES.

f.o.b. Bristol Channel ports.

I.C. cokes	20×14	box	18/-
„	28×20	„	36/-
„	20×10	„	26/-
„	18¾×14	„	18/9
C.W.	20×14	„	16/6
„	28×20	„	33/6
„	20×10	„	23/6
„	18¾×14	„	17/-
Terneplates	28×20		32/6 per box basis f.o.b.

SWEDISH CHARCOAL IRON & STEEL.

Pig-iron	£6	0	0	to	£7	10 0
Bars, hammered, basis	£17	10	0 to	£18	10	0
Bars and nail-rods, rolled, basis	£15	17	6 to	£16	15	0
Blooms	£10	0	0 to	£12	0	0
Keg steel	£32	0	0 to	£33	0	0
Faggot steel	£20	0	0 to	£24	0	0
Bars and rods dead soft, steel	£11	0	0 to	£14	0	0

All per English ton, f.o.b. Gothenburg.

TUBES AND FITTINGS.

Over ¼ in. up to 6 in.

	Tubes.	*Fittings.*
Gas	62½%	47½%
Water ..	58½%	42½%
Steam ..	55%	37½%

W.I. 12½% extra.

DAILY FLUCTUATIONS.

Standard Copper (cash).

		£	s.	d.		
Aug.	7 ..	48	3	9	dec.	7/6
,,	8 ..	48	6	3	inc.	2/6
,,	11 ..	48	0	0	dec.	6/3
,,	12 ..	47	16	3	,,	3/9
,,	13 ..	47	10	0	,,	6/3

Electrolytic Copper.

		£	s.	d.		
Aug.	7 ..	51	0	0	No change	
,,	8 ..	51	0	0	,,	,,
,,	11 ..	51	0	0	,,	,,
,,	12 ..	51	0	0	,,	,,
,,	13 ..	51	0	0	,,	,,

Standard Tin (cash).

		£	s.	d.		
Aug.	7 ..	136	10	0	inc.	20/-
,,	8 ..	136	7	6	dec.	2/6
,,	11 ..	136	5	0	,,	2/6
,,	12 ..	135	15	0	,,	10/-
,,	13 ..	134	12	6	,,	22/6

Tin (English ingots).

		£	s.	d.		
Aug.	7 ..	137	12	6	inc.	17/6
,,	8 ..	137	12	6	No change	
,,	11 ..	137	10	0	dec.	2/6
,,	12 ..	137	0	0	,,	10/-
,,	13 ..	136	0	0	,,	20/-

Zinc Sheets (English).

		£	s.	d.		
Aug.	7 ..	26	0	0	No	change
,,	8 ..	26	0	0	,,	,,
,,	11 ..	26	0	0	,,	,,
,,	12 ..	26	0	0	,,	,,
,,	13 ..	26	0	0	,,	,,

Spelter (ordinary).

		£	s.	d.		
Aug.	7 ..	16	2	6	inc.	3/9
,,	8 ..	16	1	3	dec.	1/3
,,	11 ..	16	2	6	inc.	1/3
,,	12 ..	16	0	0	dec.	2/6
,,	13 ..	15	17	6	,,	2/6

Lead (English).

		£	s.	d.		
Aug.	7 ..	19	15	0	inc.	5/-
,,	8 ..	19	15	0	No change	
,,	11 ..	19	15	0	,,	,,
,,	12 ..	19	15	0	,,	,,
,,	13 ..	19	10	0	dec.	5/-

AVERAGE MONTHLY PRICES OF STEEL SHIP PLATES (NORTH OF ENGLAND).

Year.	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Yearly average.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1896	5 0 0	5 0 0	5 2 6	5 2 6	5 2 6	5 0 0	5 0 0	5 0 0	5 0 0	5 2 6	5 10 0	5 10 0	5 2 6
1897	5 10 0	5 10 0	5 10 0	5 7 6	5 2 6	5 2 6	5 0 0	5 0 0	5 0 0	5 0 0	5 7 6	5 10 0	5 5 5
1898	5 10 0	5 8 9	5 8 9	5 10 0	5 16 3	5 18 9	5 17 6	6 0 0	6 2 6	6 5 0	6 10 0	6 15 0	5 18 6½
1899	6 15 0	7 0 0	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 12 6	7 12 6	7 12 6	7 12 6	8 0 0	7 6 5½
1900	8 0 0	8 0 0	8 2 6	8 5 0	8 7 6	8 7 6	8 7 6	8 0 0	8 0 0	8 0 0	7 10 0	7 0 0	8 0 0
1901	6 15 0	6 15 0	6 5 0	6 0 0	6 0 0	6 0 0	6 0 0	6 5 0	6 7 6	6 5 0	6 0 0	6 0 0	6 4 4
1902	5 17 6	5 12 6	5 15 0	5 15 0	5 15 0	5 15 0	5 15 0	5 15 0	5 15 0	5 15 0	5 15 0	5 10 0	5 14 7½
1903	5 10 0	5 10 0	5 15 0	6 0 0	6 0 0	6 0 0	5 12 0	5 12 6	5 12 6	5 12 6	5 12 6	5 10 0	5 13 11
1904	5 7 6	5 10 0	5 12 6	5 12 6	5 12 6	5 12 6	5 12 6	5 12 6	5 12 6	5 12 6	5 12 6	5 12 6	5 11 10
1905	5 15 0	5 17 6	5 17 6	5 17 6	5 17 6	5 17 6	5 17 6	5 17 6	6 0 0	6 10 0	7 0 0	7 0 0	6 2 3½
1906	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 10 0	7 0 10½
1907	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 0 0	7 0 0	7 8 4
1908	6 10 0	6 10 0	6 10 0	6 5 0	6 5 0	6 5 0	6 0 0	6 0 0	6 0 0	6 0 0	6 0 0	6 0 0	6 3 9
1909	6 0 0	6 0 0	6 0 0	6 0 0	6 0 0	5 15 0	5 15 0	5 15 0	6 0 0	6 0 0	6 0 0	6 0 0	5 18 9
1910	6 5 0	6 5 0	6 7 6	6 10 0	6 10 0	6 10 0	6 10 0	6 10 0	6 10 0	6 15 0	6 15 0	6 15 0	6 10 2
1911	6 15 0	6 15 0	6 15 0	6 15 0	6 15 0	6 15 0	6 15 0	6 15 0	6 15 0	6 15 0	6 15 0	6 18 4	6 15 3½
1912	7 3 9	7 5 0	7 5 0	7 12 6	7 15 0	7 15 0	7 15 0	8 0 0	8 0 0	8 0 0	8 2 0	8 5 0	7 14 10
1913	8 5 0	8 5 0	8 5 0	8 5 0	8 5 0	8 5 0	8 5 0	7 19 0	7 15 0	7 3 0	6 15 0	6 10 0	7 16 5½
1914	6 10 0	6 10 0	6 10 0	6 10 0	6 10 0	6 0 0	6 0 0	7 0 0	7 5 0	7 5 0	7 6 3	7 10 0	6 14 8½
1915	8 0 0	8 10 0	9 0 0	9 10 0	9 10 0	10 0 0	10 0 0	10 0 0	10 0 0	10 0 0	10 5 0	11 0 0	9 12 11
1916	11 7 6	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 9 2
1917	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0
1918	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0
1919	11 10 0	14 0 0	14 0 0	14 0 0	17 0 0	17 7 6	17 15 0	18 5 0	18 5 0	18 5 0	19 12 6	21 5 0	16 15 5
1920	22 10 0	23 10 0	23 10 0	23 10 0	23 10 0	23 10 0	23 10 0	23 10 0	24 0 0	24 10 0	24 5 0	24 5 0	23 13 4
1921	23 5 0	22 10 0	20 4 0	19 0 0	19 0 0	17 0 0	15 0 0	14 15 0	13 12 0	12 5 0	10 10 0	10 10 0	16 9 3
1922	10 10 0	10 10 0	10 10 0	10 10 0	10 10 0	10 4 0	10 0 0	9 7 6	9 4 0	9 5 0	9 5 0	9 5 0	9 18 4½
1923	9 7 6	9 15 0	10 5 0	10 10 0	10 10 0	10 10 0	9 18 9	9 17 6	9 17 6	9 17 6	9 18 6	10 6 10½	10 1 2½
1924	10 1 6	9 18 1½	9 17 6	9 17 6	9 17 6	9 19 4½	10 5 0	10 5 0	10 5 0	9 19 0	9 15 0	9 15 0	9 19 7½
1925	9 14 0	9 10 0	9 10 0	9 1 3	9 0 0	9 0 0	8 17 0	8 13 1½	8 7 6	8 5 6	7 16 3	7 14 3	8 15 8½
1926	7 12 2½	7 12 6	7 12 6	7 14 4½	7 15 0	7 16 10½	8 2 6	8 2 6	8 4 0	8 12 6	8 12 6	8 16 3	8 1 1½
1927	8 17 6	8 17 6	8 11 6	8 7 6	8 6 3	8 5 0	8 5 0	8 3 9	8 2 6	8 2 6	8 5 0	8 5 0	8 7 5
1928	8 2 6	8 5 0	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 6 10½
1929	8 7 6	8 7 6	8 7 6	8 7 6	8 10 6	8 12 6	8 12 6	8 12 6	8 12 6	8 12 6	8 12 6	8 13 9	8 10 9½
1930	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	—	—	—	—	—	—

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